Gas Journal

Vol. 253. 100th Year. LONDON, JANUARY 14, 1948. No. 4415. Price 1/-

Registered as a Newspaper.

PUBLIC
JAN 28 1948
DETROIT

*Lamplighter in Reverse**

Shortly after dusk in a seven-story block of offices, very well lighted. One of the tenants homeward-bound was seen switching off lights one by one in the corridors and stairways, leaving only just enough illumination to see by. He was pruning down excess, "A sort of night-gardener," as somebody said. He dubbed himself "A lamplighter in reverse"! He was setting an example in fuel-conservation and therefore doing something of significance to the nation. Waste must cease, especially the waste of the precious wealth which coal is. In mines and mills and fields and factories Production, ever more Production, is the keyword. But Production has a twin whose name is Conservation, the lamplighter in reverse. Asbestos assists us there in a hundred ways. Wisely and skilfully applied, Asbestos is coal's ally, coal's twin brother if you like. Asbestos has a part in the winning of coal and a remarkable part in the saving of it. We of Bell's, specialists in applied Asbestos, devise, design, produce and test to make Conservation constant and continual. And fuel-saving adds to efficiency and expresses itself in terms of £ s. d. whether in home or industry. Ledgers and profit and loss accounts reflect the lamplighter in reverse. Ring Bell's and put your fuel-saving problems and ambitions before us. We are specialists.

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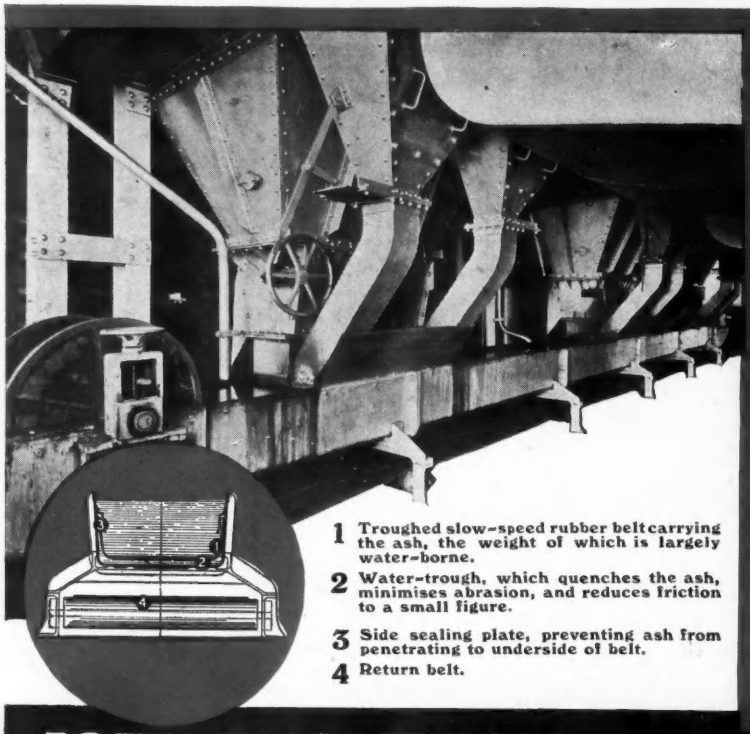
BELL'S ASBESTOS AND ENGINEERING LIMITED

SLOUGH ('phone 20211) **BUCKS**

25 Branches (including 11 in the Dominions)

**With acknowledgments to the "British Weekly"*



1 Troughed slow-speed rubber belt carrying the ash, the weight of which is largely water-borne.
2 Water-trough, which quenches the ash, minimises abrasion, and reduces friction to a small figure.
3 Side sealing plate, preventing ash from penetrating to underside of belt.
4 Return belt.

JOHN THOMPSON

Patent Submerged

ASH CONVEYORS

DUSTLESS, NOISELESS, LOW POWER CONSUMPTION

The submerged belt principle of the John Thompson conveyor reduces wear and renewals to incredibly small proportions, so that the single moving part, a rubber belt submerged in water has a long trouble-free life. This type of conveyor is adaptable to any kind of boiler plant——no excavations.

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A subsidiary of the John Thompson Engineering Company Ltd. WOLVERHAMPTON: Also Footscray, Australia

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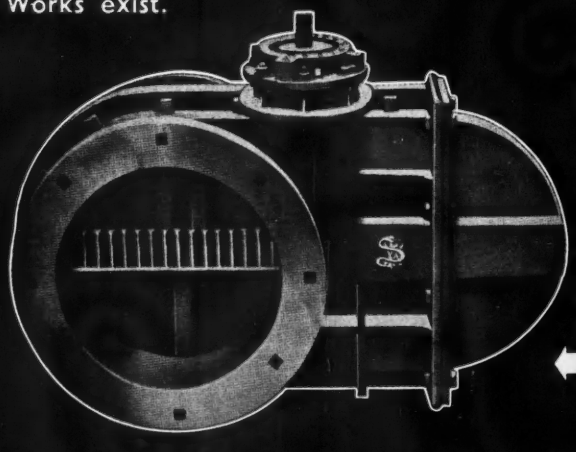
This is the number of DONKIN VALVES sold ANNUALLY. Unmistakable evidence of their popularity and reliability. They are in use in all parts of the World where Gas Works exist.



High Pressure Valve for pressures up to 100 lbs

The Standard Donkin Rack and Pinion Low Pressure Valve which has been in general use for a great number of years.

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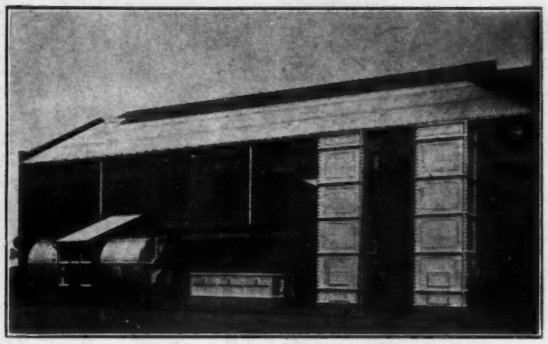

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We can meet further demands.

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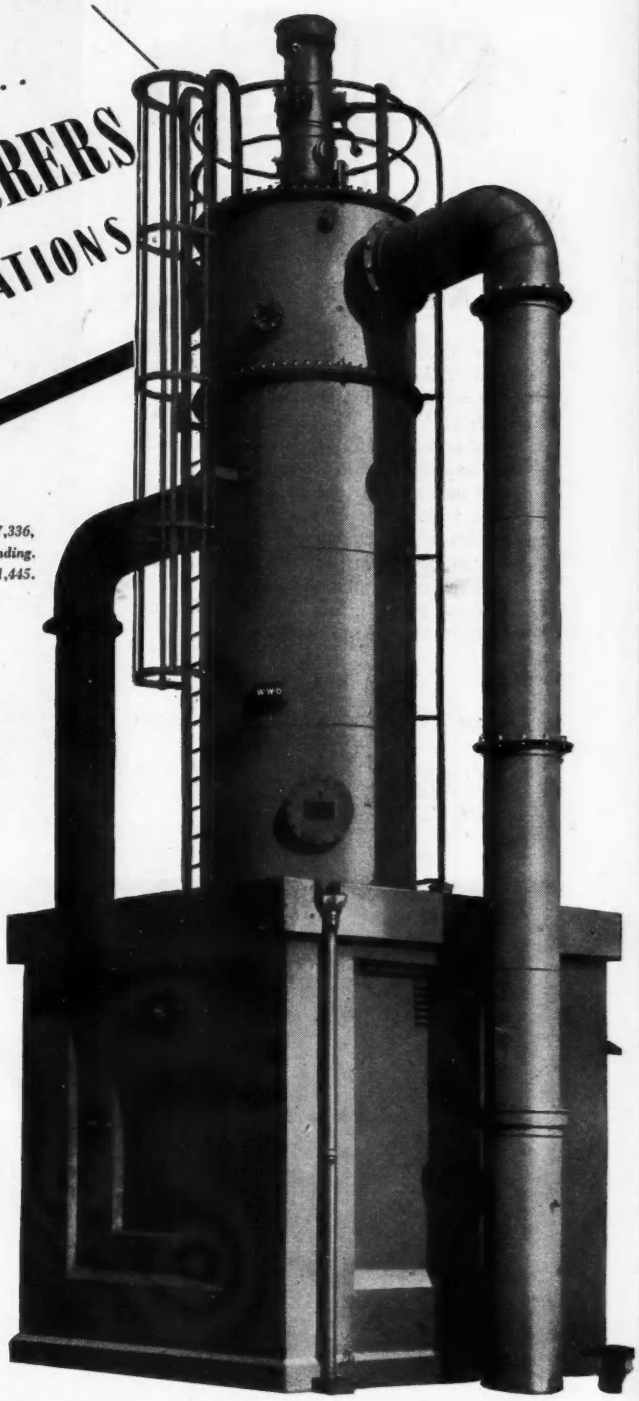
The Standard FOR COMPARISON . . .

W.W-D. ELECTRO-DETARRERS

MORE THAN 180 INSTALLATIONS

Patent Nos. 428,471, 557,336, 565, 885 and others pending. Regd. design No. 841,445.



EVERY worth while development in electro-detarring has been pioneered by Whessoe. Features introduced by Whessoe include the employment of static selenium rectifiers, exposed H.T. rectifier equipment and H.T. Switchgear, the Castell interlocking system, single-insulator discharge electrode assembly suspension, anti-swing central discharge electrode, corrosion-fatigue resisting stainless steel discharge electrodes, and many other important developments.

Whessoe have supplied more than 225 Treaters and Rectifier sets incorporating these features.

Illustration shows W.W.-D. Electro-Detarrer for carburetted water gas supplied to the order of Messrs. Humphreys & Glasgow, Ltd., for the Cardiff Gas Light & Coke Co. The capacity of this plant is 6,000,000 cu. ft. per day.

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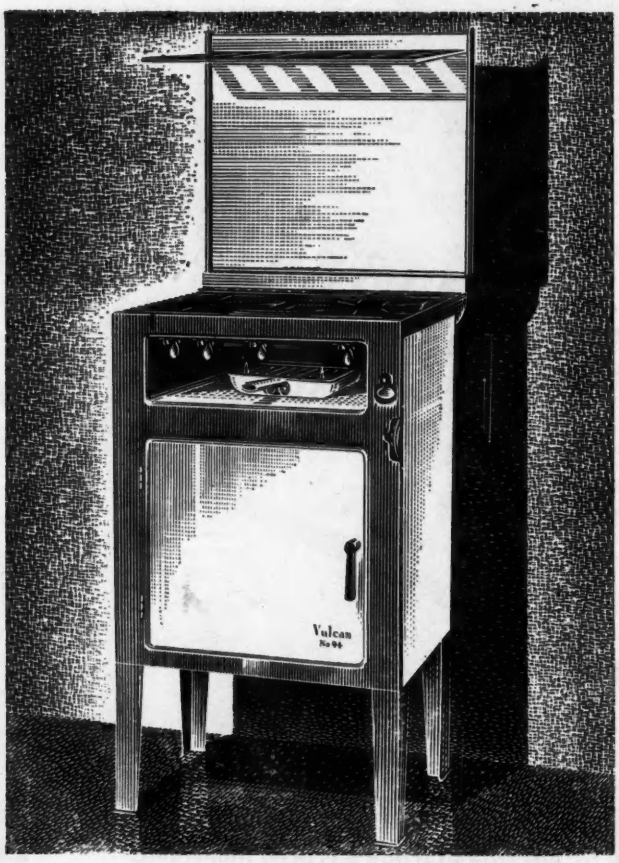
For those who prefer a leg mounted cooker the Type "L" is available with all the advanced features of the Vulcan 94 Series: Vulcan Regulator automatic oven heat control, safety type taps with efficient air-gas adjustment, vitreous finish throughout and smooth design for easy cleaning. The wide range of alternative fittings includes an extended hot plate with flue trough and splasher trim in place of the closing cover plate, illustrated, and the Vulcan patent glass door* of fireproof, unbreakable 'Armourplate.'

* *Patent No.* 401704



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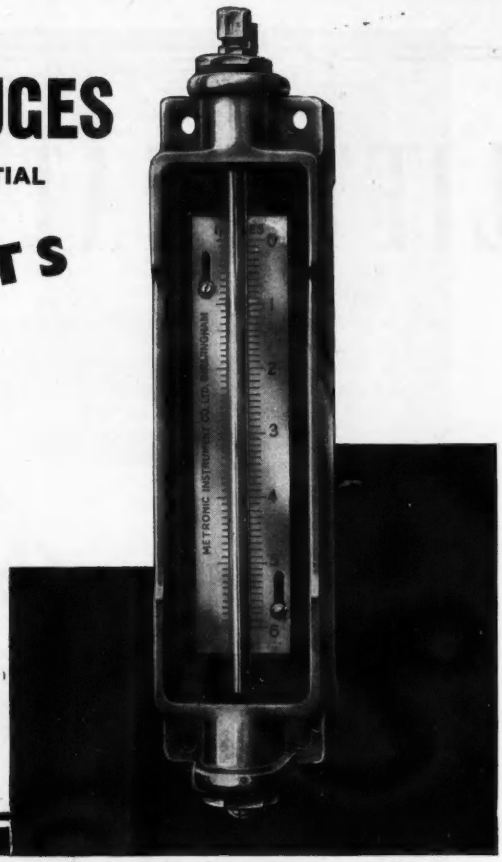

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Use Waste Heat

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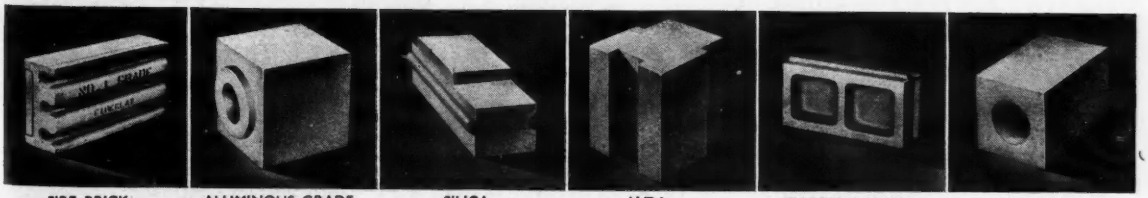

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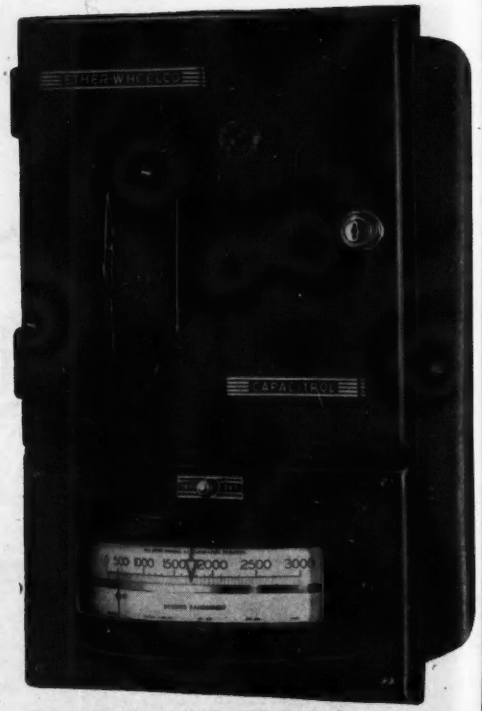
Other types are made giving two position and proportional control, these are known as the "MULTRONIC" and "PROPORTIONAL CAPACITROL.'

All these instruments utilise electronics to automatically control temperatures with the speed of light, great accuracy and no interference with the measuring system. They are faster, simpler and more accurate than the Chopper Bar type formerly used.

Send for descriptive list No. 447.



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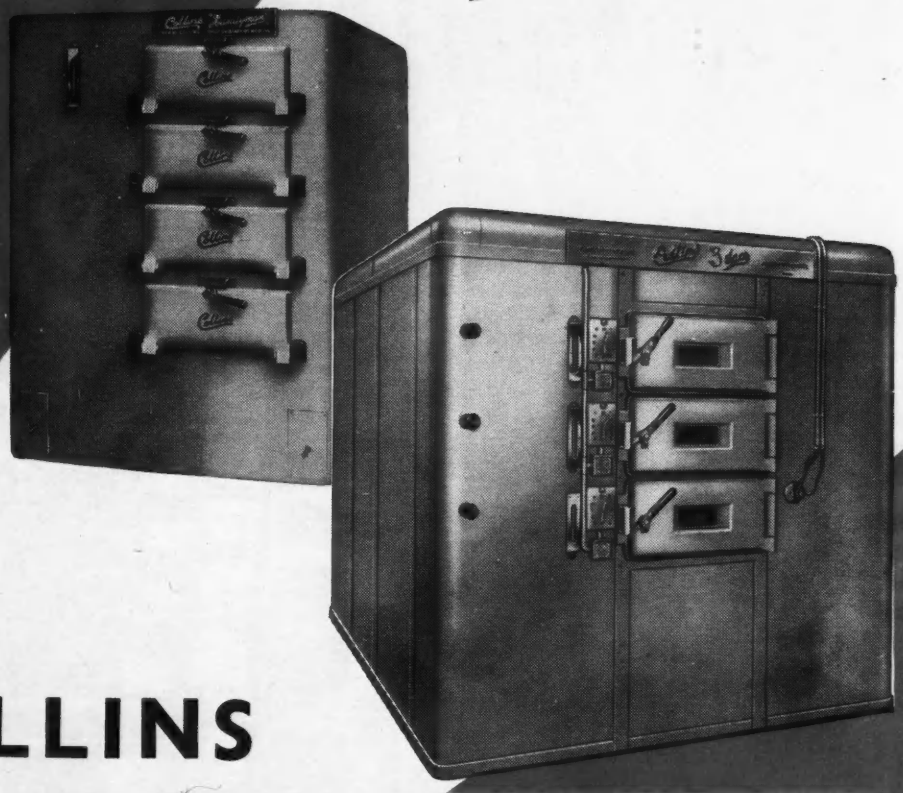

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- **All decks are worked from floor level.**
- **The special furnace ensures a solid mellow heat.**
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- **Clean and simple to operate.**

Let our Technical and Planning Dept. advise without obligation.

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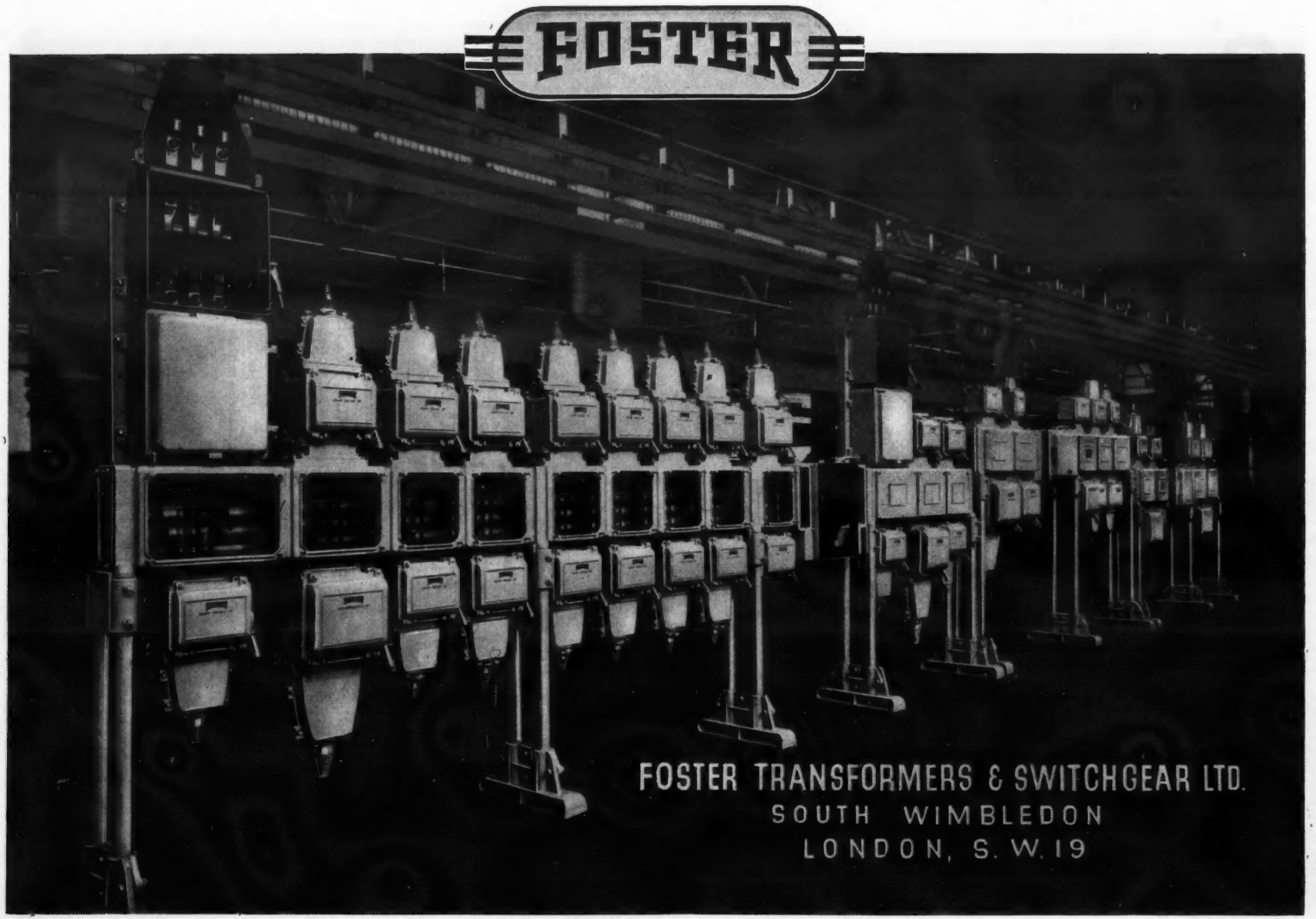
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THE SIMMANCE PATENT GRAVITOMETER

. . . WITH LARGE INDICATING SCALE AND POINTER IN ADDITION TO CHART RECORD ALLOWS OBSERVATIONS ON THE WORKS AND IN THE LABORATORY TO BE MADE AT ANY TIME . . .

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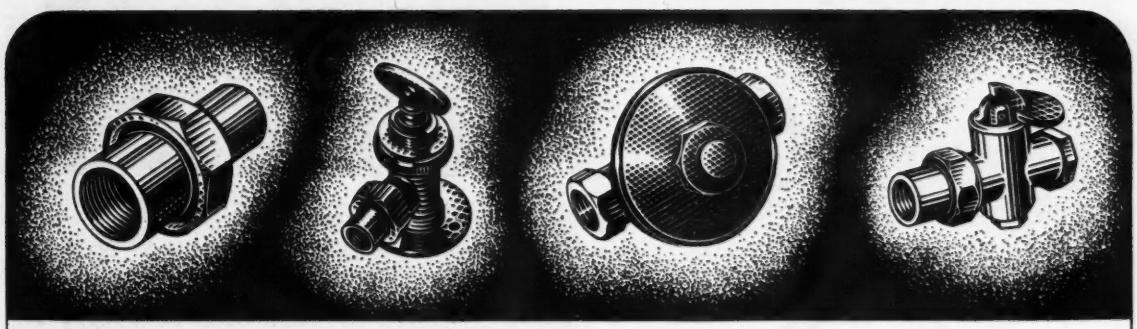

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IN *the course of a century's experience of the manufacture of fine equipment for the gas industry and kindred trades, the firm of Sugg have gained a considerable knowledge of brass and its possibilities. From small beginnings the brasswork section of the firm has developed into something of importance with an impressive output of many thousands of fittings each week. Quality is the keynote of every single piece produced. The random selection shown is taken from current production and your enquiries are welcome.*

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SUGG WESTMINSTER

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by J. Arthur Rank

"Many of you will remember the film made for Two Cities by Sir Laurence Olivier—Henry V. It was the story of a small and very tired British army, led by a courageous and determined king, in battle with a much larger enemy.

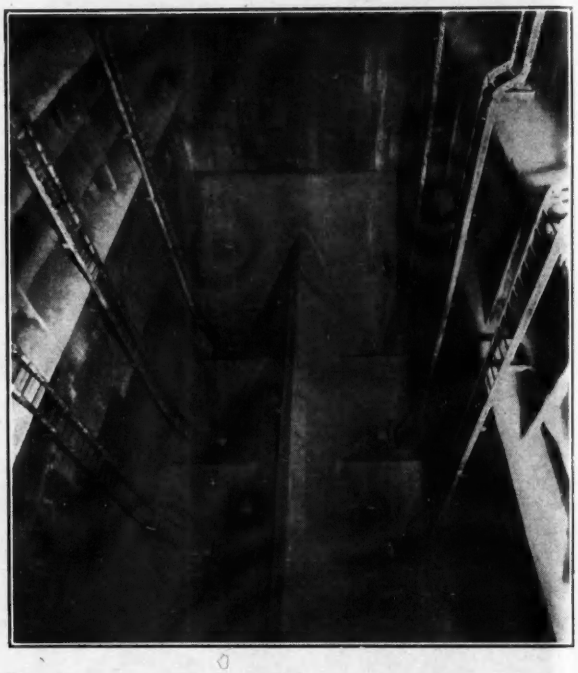
Today it is not an army that is in action: it is the whole nation. Like the soldiers in Henry V, and for the same honourable reasons, we are tired. And, like those soldiers, we need all our courage and determination to win this new battle.

We cannot all play as spectacular a part as our archers at Agincourt. But we all can make a tremendous contribution by supporting the Silver Lining Savings Campaign with all our resources and all our strength. In this present crisis increased Savings will tell the world that we are determined to win."

National Savings for Prosperity

Issued by the National Savings Committee

Gunite is PROTECTION against abrasion



Gunite—concrete applied by air pressure—has numerous applications where its great density and extreme adhesion have particular value.

For lining coal bunkers and steel chimneys it is an ideal material, possessing great resistance to corrosion and protecting steel-work from the abrasive action of the raw coal.

For repairing reinforced concrete it has particular merit, as, due to the method of application, a uniform density and adherence is obtained in whatever place the Gunite is applied, thus overcoming the common fault with hand-placed methods.

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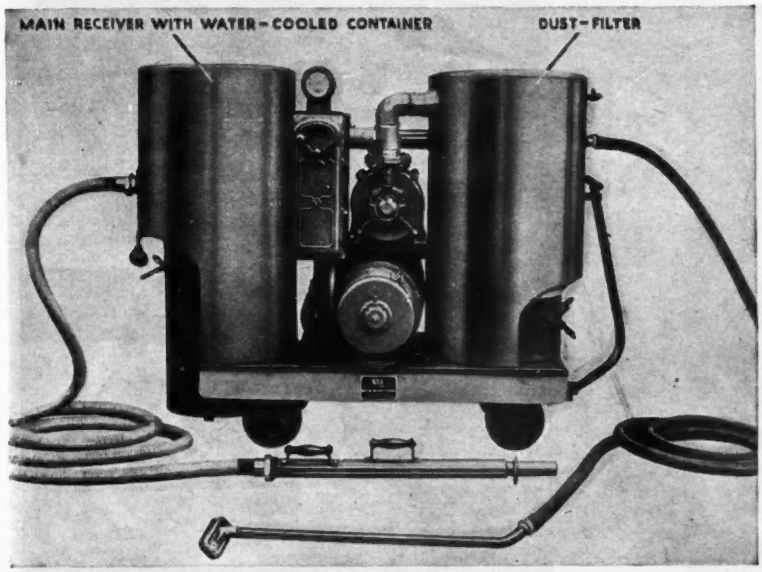
THE B.V.C DUAL-PURPOSE GAS WORKS MODEL



The B.V.C. Dual-Purpose Gas Works Model is a very efficient mobile unit, with water-cooled container for the removal of hot dust from the tops of retorts. Can be used for general cleaning by either one or two operators.

We shall be pleased to send you full information on request.

B.V.C. Flue Dust Removal Plant Equipment is used by: The Gas Light & Coke Co. (Beckton, Nine Elms, Southall and Brentford). The Birmingham Corporation Gas Co. The Cardiff Gas Co. The Birkenhead Gas Department. The Commercial Gas Co. The Reading Gas Co., etc., etc.

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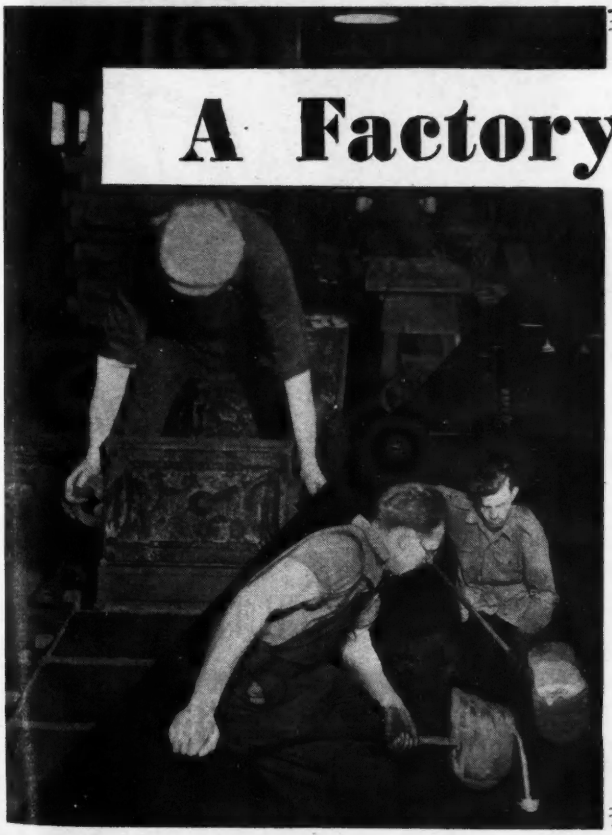
Head Office and Works: LEATHERHEAD, SURREY. *Telegrams:* VACUUMISER, PHONE, LEATHERHEAD



A Factory at Work

The handling of heavy moulding boxes and plates, the pouring of scorching molten metal into moulds, are tough and grim jobs needing strong physique as well as a high degree of skill. The resulting castings have great tensile strength, adding to the fine quality of the famous "Newhome" Cookers.

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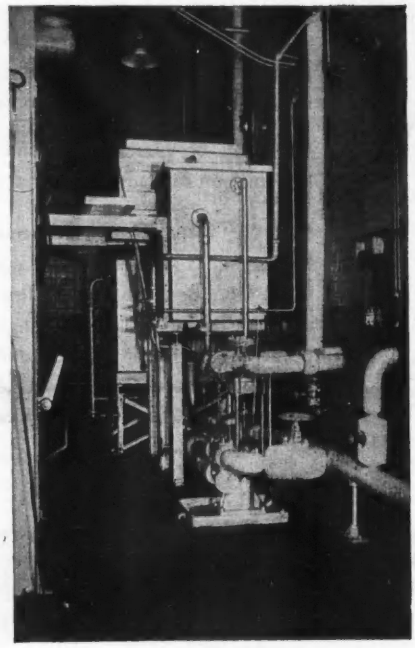

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We are glad to analyse samples of every type of water supply and submit suggestions for its correct treatment without obligation.

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Water Treatment Engineers

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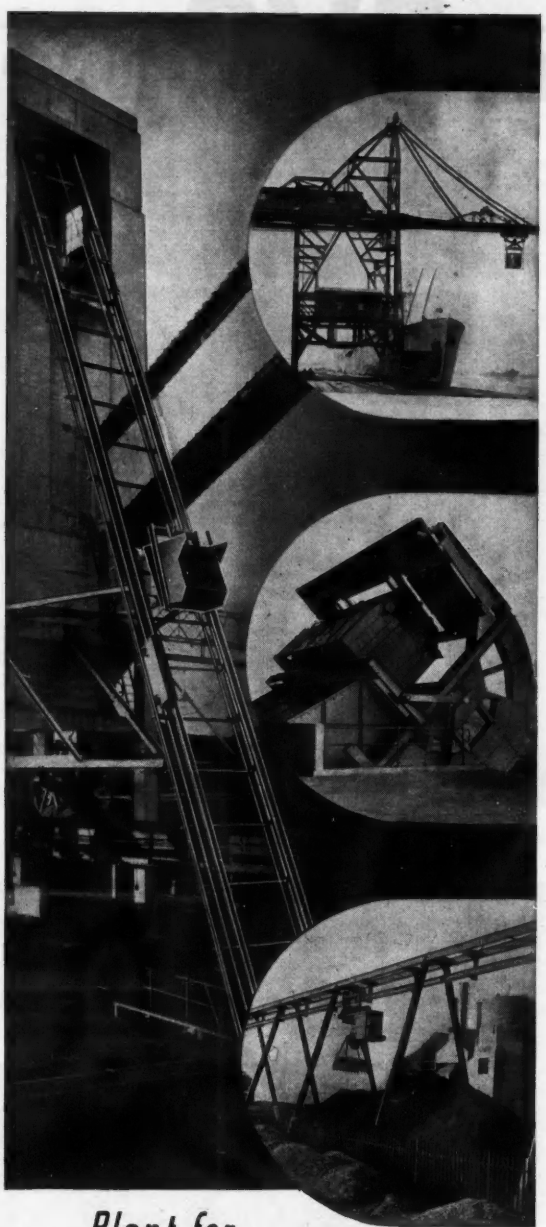

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Movement of Material in BULK

Designed, Constructed and set to work in any part of the world

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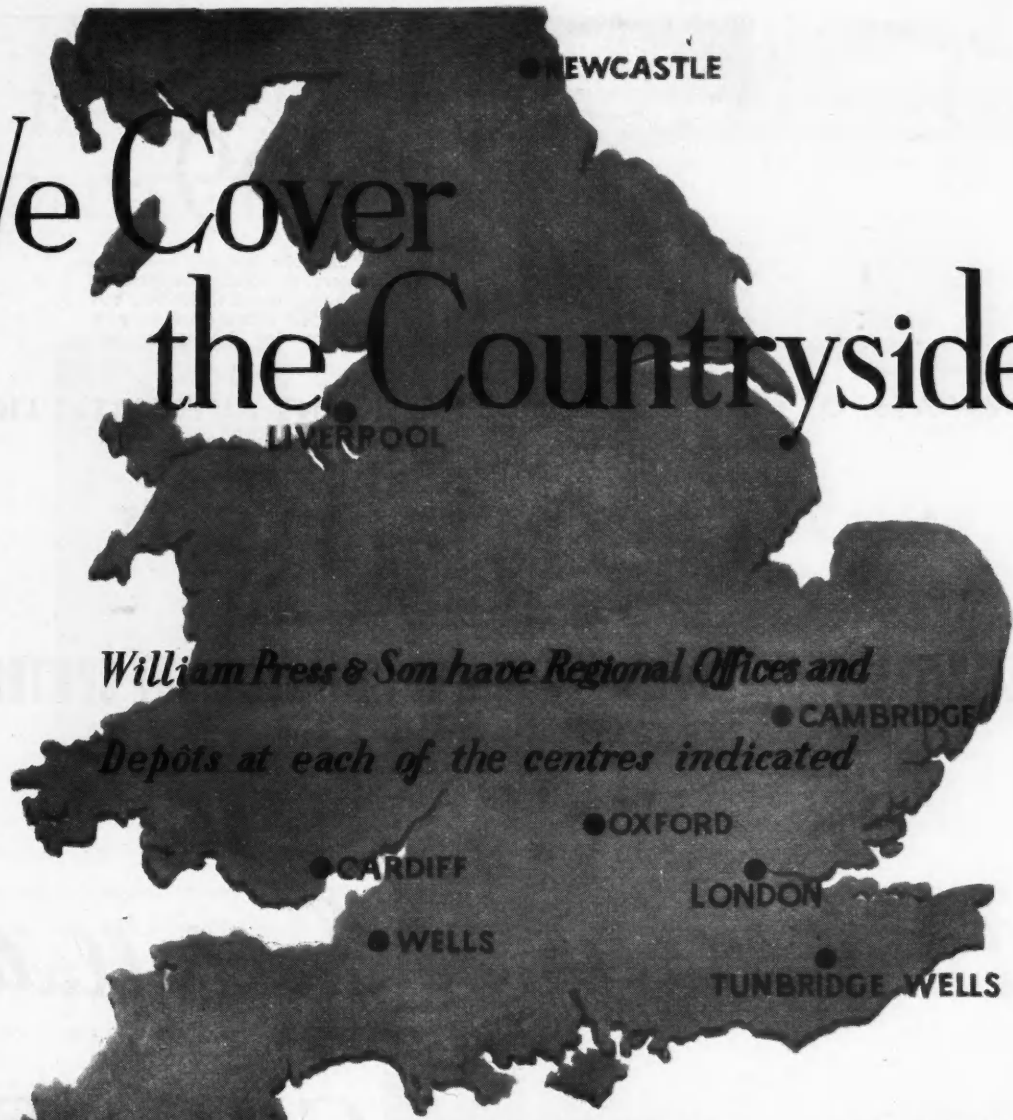

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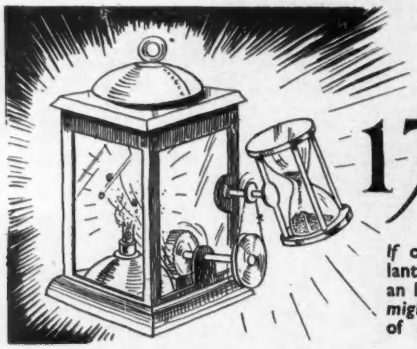

1769

If one John Box *had* invented a lantern to which was attached an hourglass and tinder box, this *might have been* the first example of controlled lighting ignition.

NOWADAYS, OF COURSE, THE MOST EFFICIENT AUTOMATIC LIGHTING APPARATUS BEARS THE NAME

"GUNFIRE"

THE TRADE MARK OF

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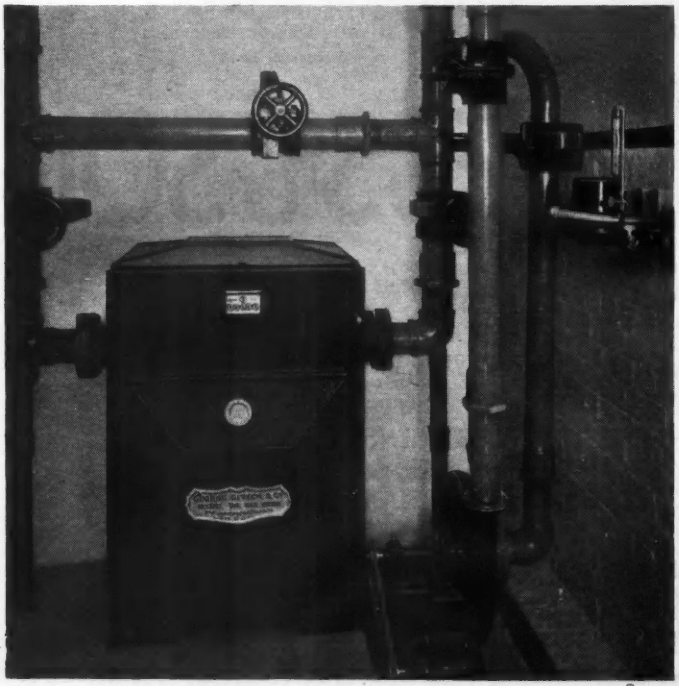
ESTABLISHED OVER HALF A CENTURY.

An Industrial Installation



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Gas Meter Manufacturers

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The "C.P." CONVECTOR (Type A)

This well-designed convector heater, faultless in construction and finish, provides efficient heating for the home, shop, office or workshop. Stove Enamelled Bronze, Beige or Green, it stands 30" high.

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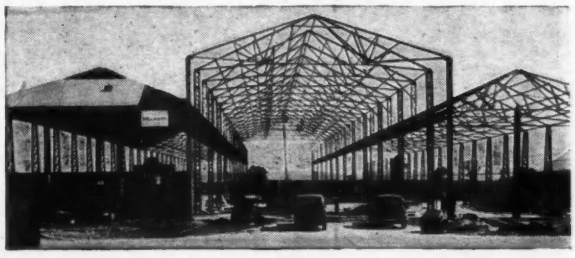
OF ALL SHAPES AND SIZES
BUT ALL OF "TOOLDOM" QUALITY

REGISTERED TRADE TOOLDOM MARK REGISTERED
The Mark of Reliability for a Century

White City Re-born !



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WE DISMANTLE • WE ERECT
WE RE-CONSTRUCT • WE BUY

Consult us if you wish to dispose of, adapt, alter or erect steel framework, towers, gantries, industrial buildings or structures of all types

Our skilled labour and expert technical knowledge are at your service

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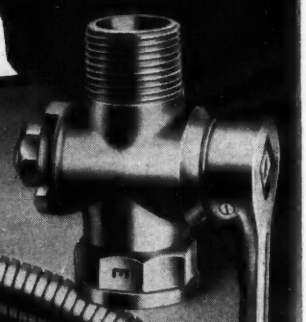
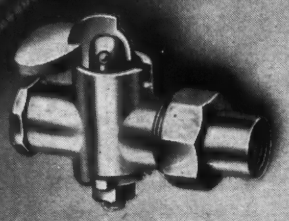
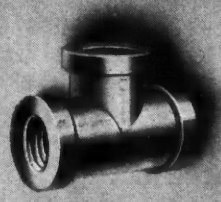
½" ¾" and 1" Hot Pressed Main Cocks



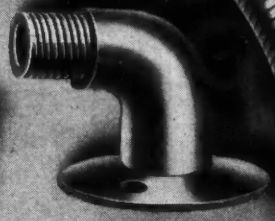
SMALL BRASSWORK



½" B.S.P. Union Cock with safety type drop fan



½" B.S.P. Equal Tee



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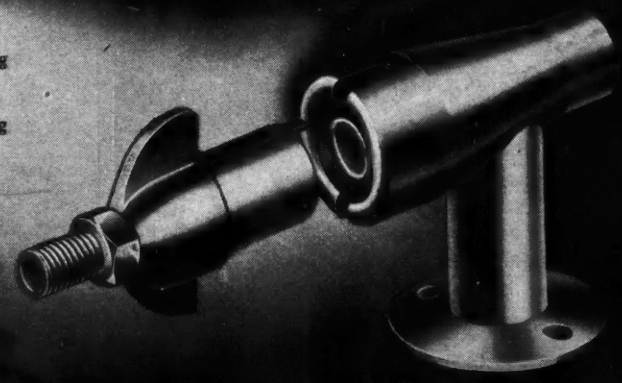

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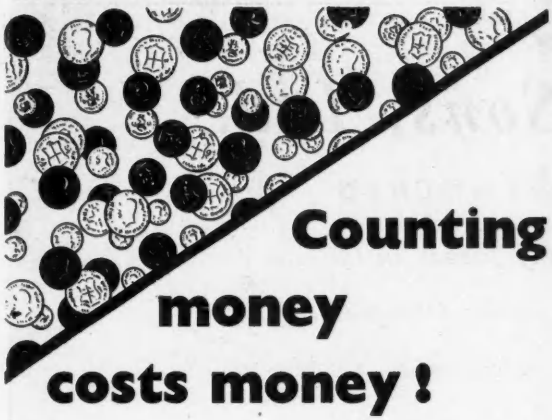

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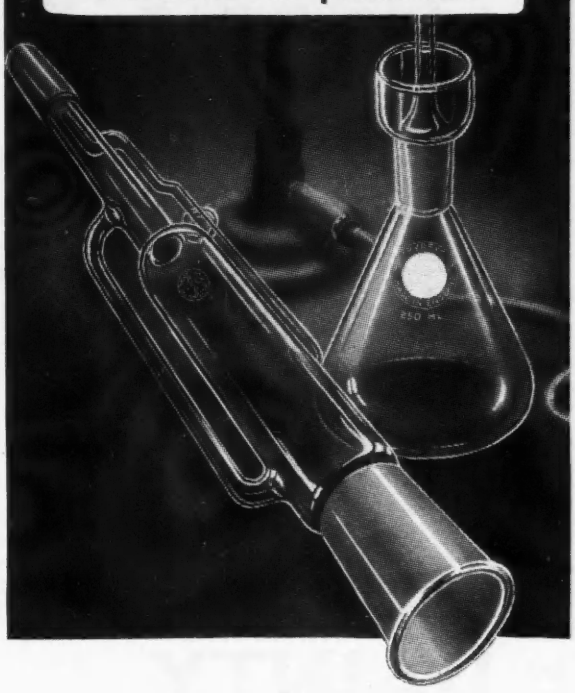

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* HOTEL, RESTAURANT AND CATERING EXHIBITION, JAN. 16-24

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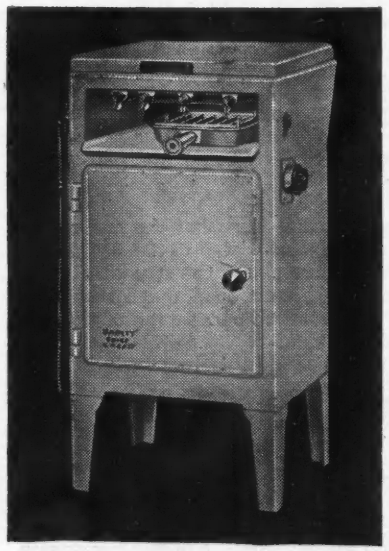

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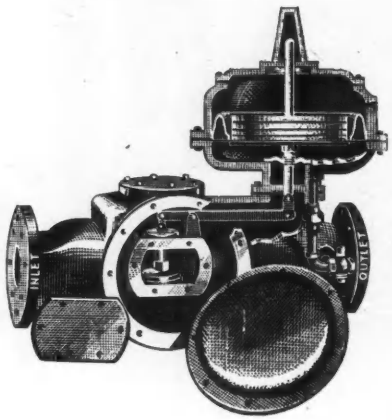

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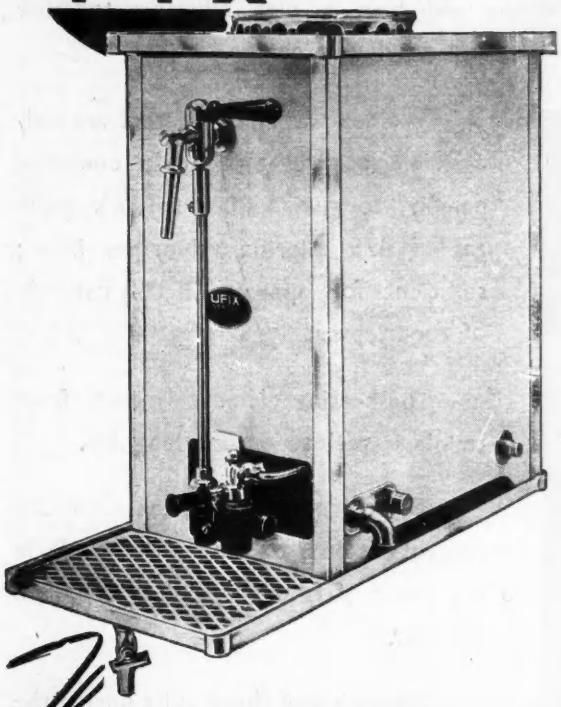

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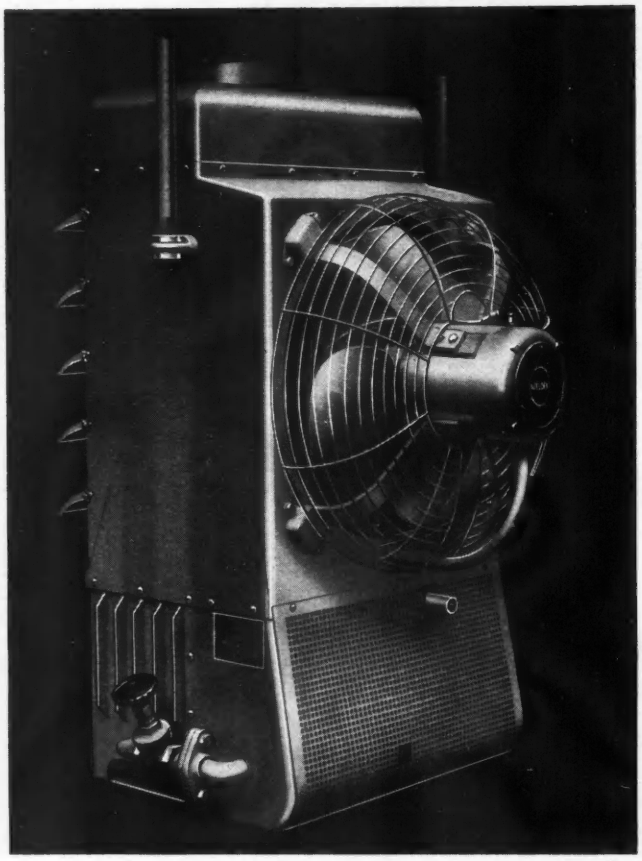

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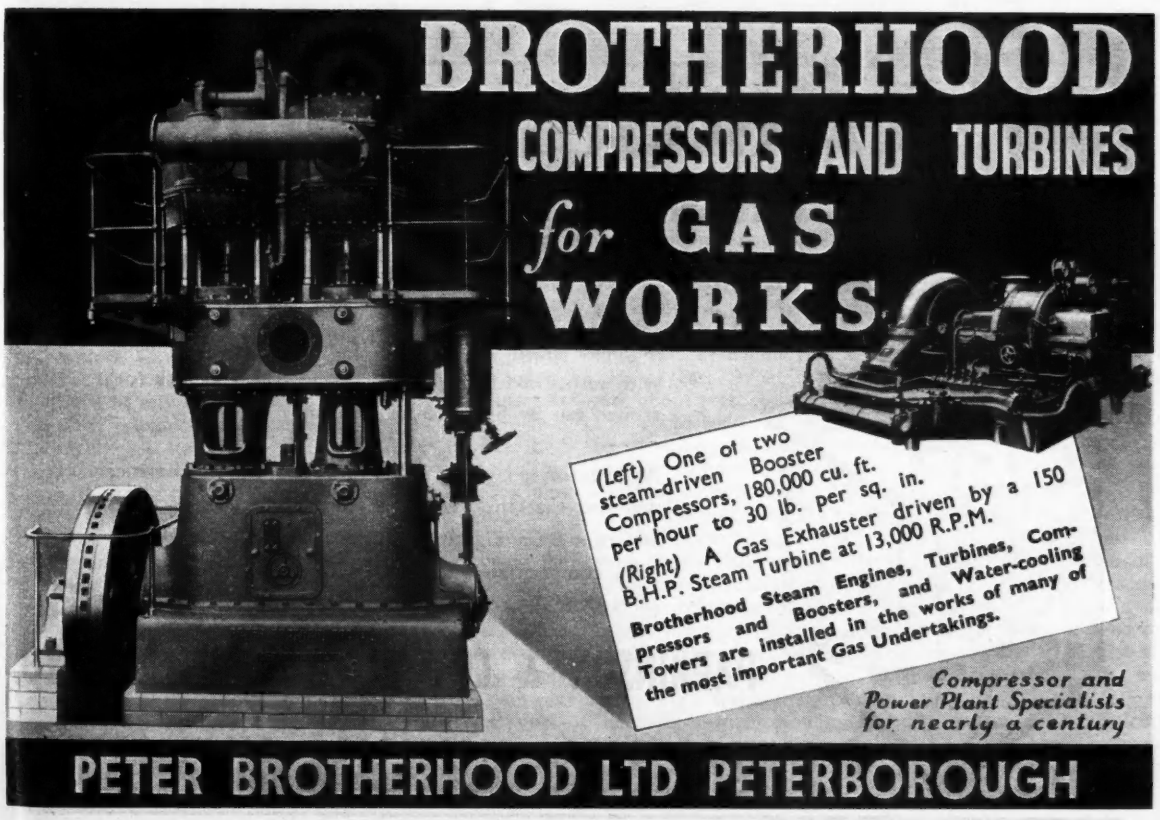
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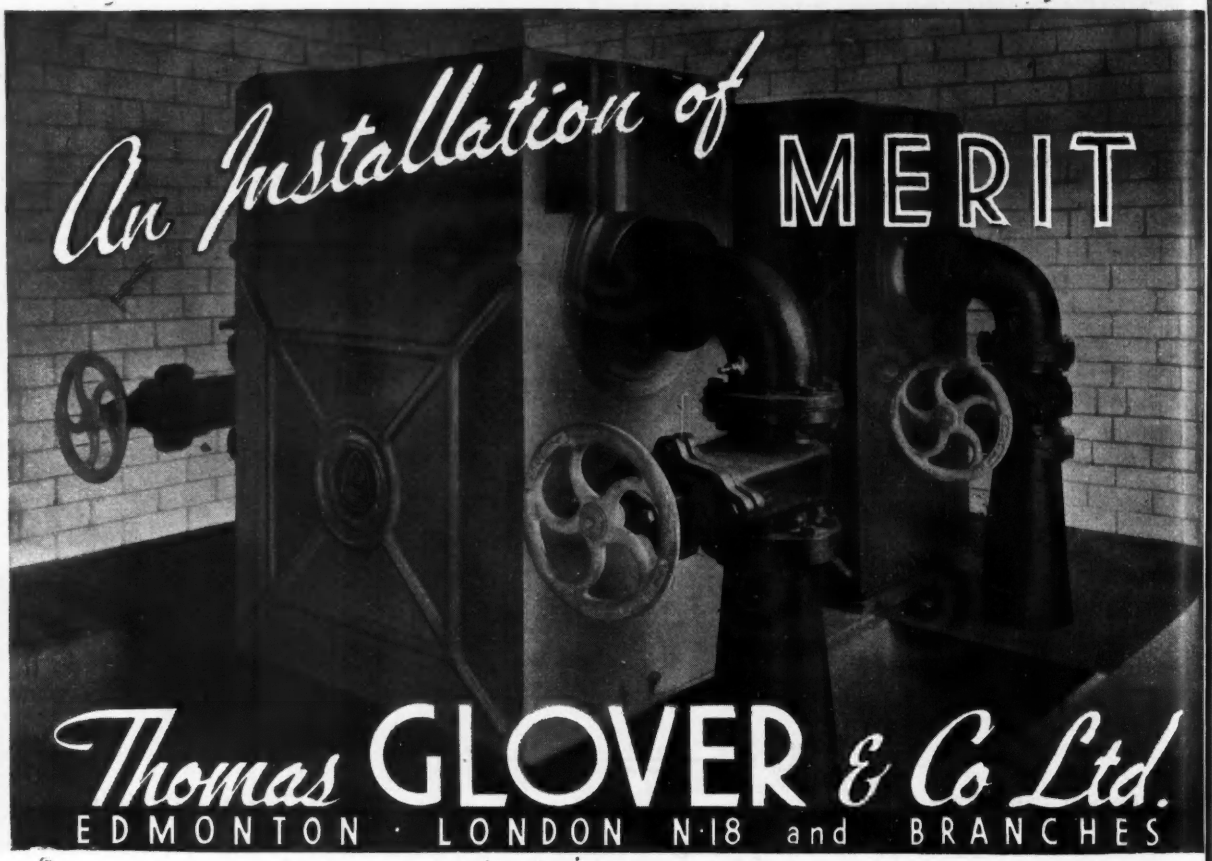

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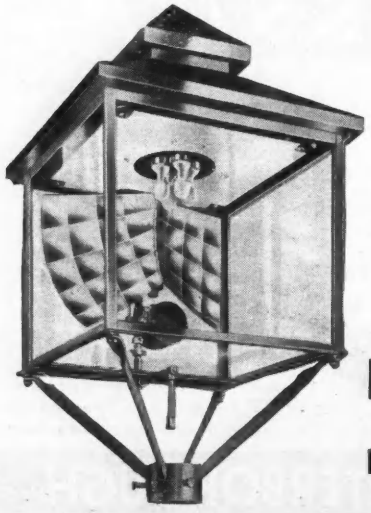

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GAS JOURNAL

Vol. 253 January 14, 1948 No. 4415

WATERTIGHT AGAINST THE COMMUNITY

AT the close of 1947, in a review of the year's activities and outstanding inconsistencies, we referred to the cleavage between the coke oven industry and the gas industry, mentioning that coke ovens supply more than 12% of the gas distributed to home and industry. Gas undertakings taking coke oven gas cannot control coke oven gas supply, which is issued arbitrarily under the flag of N.C.B. Ministers of Fuel and Power, apparently staggered, come and go, exhausted though by no means breathless. It is to be hoped that eventually some Minister of Fuel and Power will perceive that the gas industry and the coke oven industry supplying gas to the public should be placed under unified control. When the gas industry is nationalized, all carbonizing and ancillary processes—including, of course, coke production—should be concentrated in one authority. Then we shall have less need to ask for co-operation between two industries which are so obviously linked in common aim. Dual control is incompetent; it is inconsistent with a national fuel policy. Lovers of the London School of Economics may derive some warmth over discussion of minor fuel subjects such as basic petrol abolition; they ought to be assured of greater warmth in home and factory as a result of practical fuel policy. The maximum conservation and the most efficient utilization of coal can be ensured only by placing all carbonizing processes concerned with the supply of gas to the public under one authority. An arrogant declaration? We hold by it.

The twain must meet; otherwise the public will suffer. Since World War No. 1 the coke oven industry has helped the gas industry; the reverse is equally true. Much more could be done under unified control. Some large gas undertakings rely almost entirely or very extensively on coke oven gas, which means that the people in the areas supplied by these undertakings have to rely on coke oven gas. The gas industry is meeting their present demands statutorily; the coke ovens are not supplying gas statutorily. Is the Minister of Fuel and Power placing reliance on the ignorance of the public in this respect and basing his disregard of common-sense principles of fuel supply simply because the gas industry has such muted note in the House? The ownership of 53 coking plants, comprising 58% of the coke oven industry and far more than 58% of the coke oven gas supplied to gas undertakings, has been vested in the National Coal Board. These plants are primarily associated with the public gas supply. Any future British Gas Board should have full control over every source of gas supply. In the lovely and less lovely parts of Yorkshire the people are dependent on coke oven gas. For homesteads in the more beautiful districts the West Yorkshire Gas Distribution Company supplied 100% coke oven gas: for some of the less beautiful districts the Company supplied 100% coke oven gas. The area of the Sheffield and District Gas Company is wide; that area depends on coke oven gas, and through that area's enterprise what is current in our thoughts, dollar exchange. Glibly one talks about co-operation. What was this co-operation worth in the autumn of 1947? The Sheffield and District Gas Company had to ask large industrial users to cut down consumption of gas drastically; 120 of the largest firms in the Sheffield area had to be asked to cease using gas completely for industrial purposes. The National Coal Board, with hoisted flag, issued instructions to the West Riding group of gas companies to reduce their output by 45%—a decision affecting at once 3,000 industrial and more than 100,000 domestic gas consumers. These figures may be remembered by the governing group nurtured by the London School of Economics. We may remind the group that the arbitrarily created situation led to short-time working in the steel, woollen, and many other industries.

What is this co-operation worth to-day? Does or does not the body politic want a reasonable supply of gas at a reasonable price? Does the Minister of Fuel think that a common policy in the carbonizing industry is desirable?

GLOOM ABOUT DOOM?

IS the lighting load fundamentally valuable to the Gas Industry? Has the Industry woefully neglected the advancement of this load, allowing it to slip away by default? Some gas undertakings in the country have a substantial lighting load. As an illuminant gas has its attractions. Our own eyes serve us better in gaslight than in any form of electric light—that is, from a comfort point of view. Every gas lighting burner is a useful source of heat. It is a background heater, and the lighting season coincides with the heating season. This combined service is economical. Yet we think that the virtues of domestic lighting by gas provide little case in comparison with the claims of other domestic uses of gas. What about street lighting? We hear vague talk about prestige value; we find still vaguer figures relating to costs of gas street lighting. Prior to the war gas and electricity wallowed in under-cutting, and under-cutting obviously implies subsidy in one form or another. Good lighting demands uniformity. "No names, no pack drill" appeals to many as a precautionary measure. Without naming anybody we may mention that at a recent meeting of gas technicians someone who knows more than a little concerning gas lighting remarked that maintenance of gas lighting had increased since the war beyond preconceived notion. And discussing in particular the use of gas on railway stations, he mentioned that a railway line, even nationalized, ran through areas served by many different gas undertakings, and that whereas the train ran along a track of standard gauge it by no means followed that it ran through stations lighted by gas uniformly efficiently. Speaking of one particular railway concern (then a company) he recounted difficulties due to varying gas pressures, poor maintenance, general lack of precision.

Before the war the lighting load of the Gas Industry was 5% of the gas sold. In 1938 the quantity of gas sold to local authorities for public lamps was 15,000 million cu.ft.—roughly the output of the South Metropolitan Gas Company. The figure for 1944 (blackout conditions) was *circa* 2,000 million cu.ft. We do not know the figure for 1947 (peacetime conditions). Even if we put the load at 5,000 million cu.ft. it is obviously an important one to the Gas Industry if it is an economic load, and obviously a boon to the public if it is an efficient load. It goes almost without saying that irrespective of the size of the load the Gas Industry, to maintain its prestige as a public service, must maintain that load efficiently —again irrespective of whether it is fundamentally valuable to the Industry.

PROMPT ACTION ON GAS PRICES

It is good to know that the issue of the Gas Charges (No. 2) Order, 1947—briefly announced in our news columns last week —was the prompt outcome of co-operation between the British Gas Council and the Ministry of Fuel and Power. As soon as news of the further increase of 2s. 6d. per ton in the pithead price of coal, with effect from Jan. 1, reached Gas Industry House, representations were made to the Ministry with a view to the amendment of the previous Order, which restricted the general price increase permission to the direct consequences of the increased cost of coal and oil in September and October last. The Ministry, with equal promptitude, recognized the reasonableness of the request, and within 13 days of the announcement of the coal price increase Mr. J. R. W. Alexander, General Manager of the British Gas Council, was able to give the undertakings a preliminary indication that the amended Order was about to be issued. The amended Order enables the price of gas to be increased without a permit to cover the effects of *any* increase in the delivered price of coal or the net cost of gas oil, after allowing for any increases in the price received for coke.

DOMESTIC ELECTRICITY CHARGES

An increase in what he called "artificially low" prices for domestic electricity was foreshadowed by Mr. H. Gaitskell, Minister of Fuel and Power, last Saturday. He said that some undertakings which were showing a loss on domestic sales were charging industry more for current. That was a situation which could not continue. "I give this warning," he remarked, "because you cannot go on having uneconomic charges. I hope that, before the vesting day, this matter can be adjusted. If it is not, it will certainly have to be tackled as a matter of urgency by the new Electricity Boards." Mr. Gaitskell added that since 1938, while the average price per unit had increased by 0.2d., the average price per unit for lighting and cooking had decreased by 0.14d. He promised that under nationalization regional electricity organizations would not be unduly interfered with from Whitehall.

THE LANCASHIRE COALFIELD

At a Press conference in Manchester this month the Chairman of the North-Western Division of the Coal Board, Mr. J. A. Webb, referred to six major schemes for the reconstruction of collieries. Lancashire, he said, would have a provisional planned output of 13,000,000 tons a year. Of this the reconstructed collieries would produce about 7,500,000 tons, and the rest would come from other collieries and new sinkings. Manpower would move from the collieries that closed down. For example, the developing St. Helens area would be fed from the declining Wigan coalfield—which had no future, it was said, but gradual extinction—and reconstructions round Manchester would get their men from exhausted or condemned pits. "It will be obvious," the statement went on, "that as efficiency improves the necessary manpower will decrease. There are 50,500 on the Lancashire colliery books. Assuming an annual output of 13,000,000 saleable tons a year, if and when productivity reaches 30 cwt. a man-shift, the number needed might be about 37,000." The relative decrease would be greater on the surface than underground. A million tons a year was the aim from seven drift-mining projects planned for the immediate future. One of them is in the Wigan area and the rest are in the Burnley area. These schemes have a short life, the statement was careful to point out, but Mr. E. H. Browne (Production Director) said they lent themselves to a high degree of mechanization and were an attractive proposition. Mr. Browne emphasized that new sinkings must take second place to reconstruction. They were interested in the Prestwich and Whitefield area, though it was too early to talk of a definite project. "When we have got ahead with our great reconstruction programme we shall explore that area very carefully indeed."

HELPING AGRICULTURE

Last week we published a summary of the annual report of the British Sulphate of Ammonia Federation and commented on the progress that has been made with the successful application of sulphate of ammonia to British agriculture. In this issue we follow up the story of how the Gas Industry helps agriculture on the fertilizer side with a description of the experimental communal grass drying plant at Thornbury, to which the Industry makes an equally important contribution by way of solid smokeless fuel. It has long been recognized that many agricultural processes are directly and indirectly associated with the use of heat; indeed, it is some seven years since the London and Counties Coke Association added an agricultural adviser to its technical staff with a view to the more effective solution of agricultural problems. It is also about six years since the L.C.C.A. published its *Combine Harvesting and Grain Drying*, dealing with specialized agricultural subjects and the use of fuel on the farm. Since then the importance of grass and grain drying has been increasingly recognized but, until the Milk Marketing Board, in collaboration with Imperial Chemical Industries, Ltd., carried out their Thornbury experiment, the practice of drying was almost entirely confined to individual farm plants. As something like 90% of the farms of this country are too small to justify the installation of individual plants, progress has been necessarily limited, but the communal scheme now described seems to offer the ideal solution. Not only is fuel used with the greatest economy, but the whole process of fertilizing, harvesting, transport, drying, and ultimate distribution of the dried grass, is organized on a basis which secures the maximum of benefit to the participating farmers. A few of the individual drying plants in this country are gas-heated, and they are extremely successful from the operational point of view, but in present economic circumstances coke is the ideal fuel for the purpose. The Thornbury plant points the way to far-reaching developments.

EXHIBITIONS

An exhibition is a glorified shop window without the glass front. It is an occasion, however, for greater display craft and cunning, because the public can see exhibits at short range and can, in addition, walk all round objects and inspect them in detail. In recent years the technique of stand construction has been immeasurably improved, compared with the former technique, and there is something exciting about recent layouts at some of the more imposing exhibitions. It is difficult to get materials now, and the cut in wood imports is going to worsen the position. Costs will keep on rising as the materials get scarcer and the time for improvization with second-hand materials has definitely arrived. Any shortages will have to be offset by the design that is adopted. But the fundamentals such as lighting, colour, and positioning, are supremely important; there is never any need to transfer the whole showroom to an exhibition hall. Massed products, like massed bands, have their place in the scheme of things, and are apt sometimes to lead to a wearying confusion.

NO PREFERENCES

One possible advantage of nationalization will be the elimination of the unreasonable competition which company-owned gas undertakings have had to meet to an increasing extent in recent years from municipally-owned electricity undertakings. The matter has been raised in many different ways and in different towns, and the latest instance is that of Peterborough, where the local M.P. has written to the Corporation stating that his attention has been drawn to the fact that citizens who have been allocated Council houses have been visited by representatives of the Electricity Department in an effort to secure their agreement to become consumers of electricity. Such visits were the first intimation the people concerned had received that they

had been allocated Council houses. The privilege accorded to the Electricity Department, he pointed out, placed the Gas Company at a disadvantage, and he asked whether in view of the Ministry's policy in the matter it was possible to offer the same facilities to the Gas Company. When the correspondence came before the Council, a member wanted to know the position if a person ordered an electric fire and then learned that he was not to have a house after all. The Town Clerk replied that there had been one case where a man saw his name in the papers and on the strength of it, and after having a visit from a representative of the Electricity Department, ordered furniture and other things, thinking he was going to get a house within two or three weeks. The point, and it was a very dangerous one, was that if anyone from the Electricity Department went to a man and said "You are going to get a house," and the minutes had not been confirmed by the Council, the Council would be liable for any contract that man entered into. A prospective tenant could not be absolutely safe in regarding himself as a tenant until he had signed the tenancy agreement. The Council ruled that in future Electricity Department representatives should not canvass persons provisionally selected for the tenancy of Council houses until after selections made by the Housing Committee had been confirmed by the Council.

Personal

Mr. L. H. PLATT, of the Malton Gas Company, has been appointed Chief Clerk and Commercial Assistant to the Loughborough Gas Department.

* * *

Mr. EDMUND BATES, M.Inst.F., Sales and Service Superintendent, Nottingham Gas Department, has been elected Hon. Secretary of the Nottingham Fuel Savings Campaign Working Committee.

* * *

We stated last week that before the war Mr. J. E. P. BROOKS was Accountant to the Uxbridge, Maidenhead, Wycombe and District Gas Company. It has been pointed out to us that, although associated with the Company, Mr. Brooks did not in fact occupy this position with the Company.

* * *

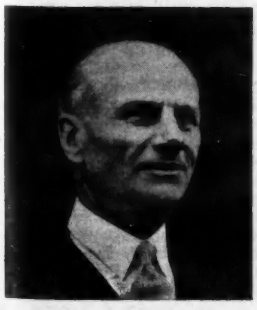
Mr. and Mrs. ALEX NEIL, of Doune, Perthshire, celebrated their golden wedding on Dec. 31. Mr. Neil, who is 74, was Manager of the Gas Department of Doune Town Council, a post he took over from his father when the latter died in 1917 and which he held until his retirement in 1938.

Obituary

Cyril G. Davis

In the early hours of Jan. 2, as briefly reported last week, CYRIL GEORGE DAVIS passed on. He died where he wished to die—in his London home at Cadogan Place; and he leaves a widow, a daughter, a stepson—Mrs. Sybil Davis, Mrs. Peta Stocker, and Colonel Jack Christopher—and two grandchildren.

Cyril Davis was born on Aug. 26, 1874, and was educated at Framlingham College, of which school he afterwards became a Governor. Before bringing him into the family business his father insisted on his having experience elsewhere, and it was with a background of several years in general business, terminated by a visit to the United States, that in 1896 he joined the Davis Gas Stove Company. Here he started as a junior salesman and from this modest beginning worked his way up until, in March, 1907, he joined the Board. On the death of his elder brother, Harold Davis, in 1937, he became Chairman of the Company. When the firm joined the Radiation Group in 1919, he was elected to the Board of Radiation, Ltd., of which he became Deputy Chairman in July, 1941.



In 1907 he was largely responsible for starting the Davis Company's Technical Department at Luton, but his major interest was the art of selling. At the turn of the century, he opened showrooms in Queen Victoria Street, and in 1914 he was responsible for the Gas Exhibition Salons at 60, Oxford Street. Many in the Industry will remember the great impression created by this forward move.

In 1932 the Davis Showrooms were moved once more—this time to their present quarters at 7, Stratford Place, hard by the historic Derby House. Here, in the third week of last October, Cyril Davis made one of his last public appearances as host at a small reception to a number of well-known women in the Industry. At Stratford Place showrooms he had installed many examples of the Panel gas fire, in the conception and development of which he and the late Sir Lawrence Weaver were the pioneers.

In pursuance of his many activities in furthering the gas appliance industry he was closely connected with the Society of British Gas Industries, in which he held uninterrupted office from 1917 to 1928.

Outside the Industry he will be remembered as a keen yachtsman and golfer—he was a member of the Royal Thames Yacht Club and the Lucifer Golfing Society. He was one of the very early motorists, driving his own car in the 'nineties and was one of the first to use a car in business. He was a Past-Master of the Evening Star Lodge. In December, 1920, Cyril Davis contributed an article to the firm's house magazine, and there is no better expression of his own philosophy of life than the following paragraph contained therein: "Happiness is no doubt the one thing in this world that most of us are seeking, and I would say that the best means of obtaining it is to apply oneself whole-heartedly to all one's undertakings. We are all workmen, although some of us have to wear cuffs and collars, while others are allowed more freedom in this respect; but we all have the same aim, so let us all work together as one unit, with the common desire of making a success of our respective jobs."

Mr. **R. J. Rogers** writes: The passing of Cyril Davis will be mourned by a great many people in the Gas Industry, not only by those engaged, as he had been, on the appliance manufacturing section of the Industry, but by a host of friends associated with gas supply undertakings.

My friendship with Cyril Davis extended over a long period of years, and I should like to pay my humble testimony to him as a business friend. Others who were privileged to enjoy his companionship in his private and family circle can better render tribute to his many lovable traits as a family man. I well remember our first meeting, and the opinion I then formed of his charming personality and sterling character has been strengthened with the passing years.

He played a prominent part in establishing the organization with which he had been associated for the whole of his business life, and many employees have reason to remember his generosity.

He was Chairman of the Council of the Society of British Gas Industries in 1920-21, and was ever ready with his experience to help in promoting the prosperity of the Gas Industry. His youthful spirit animated his outlook on business enterprise, and his advancing years did not dim his appreciation of the need of progressive development to meet the requirements of the gas consuming public.

He will be remembered for his integrity and fair dealing in his business life; for his loyalty to those associated with him in business, including those in competitive organizations. He had the happy facility of handling difficult business negotiations without giving offence to those whose opinions might differ from his own.

My recollections, and those of many others, will revert to the many happy times spent with Cyril Davis on the golf course. It can truly be said of him that he "played the game" not only on the field of sport, but in the field of his many business activities. He derived considerable pleasure and satisfaction from his association with his many friends in both work and play, and was an ideal companion.

During his most useful and happy life, Cyril Davis made a host of friends who will always cherish his memory, but he never made an enemy.

* * *

The death is reported, as the result of a cycling accident on his way home from business, of Mr. A. C. BLENCOWE, of Kidderminster, Office Manager at the Wilden Ironworks of Richard Thomas and Baldwins, Ltd. He entered the service of Baldwins, Ltd., 42 years ago, and was highly esteemed by the staff and management.

Diary

Jan. 15.—British Gas Council: Industrial Gas Development Committee, Gas Industry House, 2.30 p.m.

Jan. 16.—Scottish Junior Gas Association (Eastern District): "Instruments," Mr. Lees (Negretti and Zambra, Ltd.). Edinburgh.

Jan. 16.—Scottish Junior Gas Association (Western District): Paper by D. D. Burns (Glasgow) on a financial subject. Royal Technical College, Glasgow.

Jan. 17.—Yorkshire Junior Gas Association: Short Paper Meeting, Huddersfield.

Jan. 17.—South Western District Salesmen's Circle: "Space Heating by Gas and Space Heating Equipment," H. E. Robinson (Radiant Heating, Ltd.), Bridgwater, 2.30 p.m.

Jan. 19.—London and Counties Coke Association: Finance Committee 11 a.m., Executive Committee 11.30 a.m., Central Committee, 1.30 p.m., Gas Industry House.

Jan. 20.—Midland Junior Gas Association: "Repair and Maintenance of Gas Fired Furnaces," L. V. S. Mann (Birmingham).

Jan. 20.—Wales and Monmouthshire Junior Gas Association: Visit to works of Porthcawl Gas Department; address by H. Short.

PARLIAMENTARY NOTES

by "ABARIS"

Electricity Peaks — Gas for Motor Vehicles — Gas Mantles and Gas Fire "Elements" — Foreign Coal — Liquid Pitch — Coke

HON. Members worked hard and furiously during the last session, and a great deal of legislation went through the prescribed stages. The Budget and the Parliament Bill produced a certain amount of heat, as did the proposed use of emergency powers, but as the day of adjournment approached there appeared to be a general relaxation. The arrival of Christmas is usually regarded as the usher of goodwill; courtesy, with that touch of rare humour, was not absent. The King's Speech had forecast a number of measures, and three only of these had not been brought out of the Parliamentary bag. They are: Deprived Children, Electoral Reform, and the Nationalization of the Gas Industry, the last requiring no elaboration in these notes. I quote from the *Economist*: "For the nationalization of the Gas Industry it is, of course, possible to make out in theory a respectable case; but would not the Government be well advised to make a success of coal and transport before adding another item to its already overcrowded plate?" The moving finger has written, but the words are not yet decipherable.

During the last few days in Parliament, the Minister of Fuel and Power answered a number of points raised verbally and in writing, and some of them are worth recording. The Member for Edinburgh asked about the effects of staggering as the result of recommendations, and what the peak load periods were; he enquired if it was possible to reduce domestic and other electricity consumptions during the peaks. The Minister replied that the national peak load periods varied slightly with the season, but were at that time between 7 and 9.30 in the morning, and between 4 and 6.30 in the afternoon. The highest half-hours were between 8 and 8.30 a.m. and 5 and 5.30 p.m. The figures available to show the effect of staggering on the peak load were obscured, he said, by many variable factors, but it was clear that a considerable contribution towards reducing peak load had resulted from arrangements made by industry in transferring load to other times of the day, and by the use of other sources of power. "After allowing for the considerable increase in the domestic and non-industrial load at peak periods which appears to have taken place, it is reasonable to conclude that the efforts of industry have produced a transfer of between 750 and 1,000 megawatts from the peak periods. Any further reduction in peak load must come from the domestic and non-industrial consumer."

With petrol rationing still a very thorny subject, Mr. Gaitskell was asked, in writing, if it was permissible to run a car on gas, or any other type of fuel. He replied that he did not, at present, propose to restrict the use of gaseous fuels for that purpose.

[I think that the Gas Industry could legitimately say in this connexion that most undertakings have neither the plant nor the labour to cope with any large "ancillary" demand for gas which could be met by better means. We are not at war. Why pander to basic petrol abolitionists?]

A question of statistical interest was asked by Sir E. Graham-Little, who wanted to know if the coal output figures given to the public were based on the coal weighed at the pithead, or whether they were based on weights after screening and washing. The Minister replied that the figures related to saleable output—*i.e.*, after removal of the dirt.

On another occasion, the Member for Sunderland asked the President of the Board of Trade if he was aware of the shortage of gas mantles in Sunderland, and of the hardship occasioned to householders who depended on gas for illumination. Mr. Belcher, replying, said that the shortage of certain raw materials had brought about a shortage of mantles all over the country, but the Government was doing its best to rectify the matter. Production in 1947 was about 12% higher than in 1946.

Polish coal has been imported, and for the five months ended on Nov. 30, 1947, 80,000 tons had been received in Great Britain. Another question concerning imports dealt with American coal. Mr. Gaitskell said that the cost of this coal, including ocean freightage, was unlikely to exceed £5 a ton. One Hon. Member pointed out that the Dumfries Lunatic Asylum had bought some of this coal for 40s. 6d. a ton.

The Minister of Transport was asked what amount of coal had been moved coastwise during the last convenient period, and whether he was satisfied that coastal vessels were playing their full part in relieving inland transport of coal carriage. Mr. Barnes gave a yes, to the second part; as to the first, between Oct. 15 and Nov. 15, 2,190,700 tons had been carried coastwise, and was the greatest quantity that had been moved by sea, in any one month, for several years. This reflected great credit on all concerned, he said; in particular, the ships' crews and those responsible for loading and discharging vessels.

What action was being taken with regard to the supply of "fuel elements for gas fires?" To this, Mr. Gaitskell replied that he was aware of the shortage, but that production was increasing satisfactorily. It would be some time before we overtake demand.

Liquid pitch received attention when the Member for Spen Valley asked what the present price was in the West Riding to industrial firms who used it for power production, and what the price was six months before; what was the reason for the substantial increase? Mr. Gaitskell said that the maximum price at which liquid pitch was delivered to the West Riding was 119s. a ton, and that there was no agreed maximum price six months before, because it was then the subject of agreement between individual producers and users. The new maximum was based on the calorific value of pitch by comparison with that of competitive fuels.

The Secretary of State for Scotland, in reply to a written question, said that on Dec. 5, 1947, 405 German prisoners of war were employed on hydro-electric schemes in Scotland, and that it was intended to increase that number to 700 in the near future. The pay of these men, he understood, was 1½d. an hour for skilled workers and ¾d. an hour for unskilled, with bonuses for good work.

The Minister of Fuel, on another occasion, was asked how soon stocks of coke allocated to distributors would be sufficient for them to meet the allowances of householders. He said that there was still a severe shortage of the fuel owing to the increased needs of industry, and that he could give no assurance as to how soon, or to what extent, the demands would be met.

Parliament re-assembles on Jan. 20, and we may look forward to the next session either with hope or with misgiving. One thing is certain, many Hon. Members will look forward keenly to the next adjournment, for the coming weeks will be full of affairs, and men are still only human beings.

DIARIES AND CALENDARS

Complimentary diaries and calendars have been almost as scarce this season as at any time during the war; the few we have received have been the more appreciated for that reason.

From the British Vacuum Cleaner and Engineering Co., Ltd., we have received a colourful wall calendar with a view of the Leatherhead offices and works; from Foster Brothers, Ltd., a folding calendar with a useful chart and data on pre-war, wartime, and post-war gas tube standards; from the Standard Furnace and Setting Co., Ltd., a handsomely produced and most useful pocket diary, including a "Business Man's Section" and a series of maps; from Stewarts and Lloyds, Ltd., a tastefully designed desk calendar of the semi-perpetual type with monthly change; from and Automctive Products, Ltd., an artistic and unusually colourful wall calendar with six pictures (two months to each sheet).

BRITISH TAR CONFEDERATION

At the Annual General Meeting of the British Tar Confederation and at a meeting of the Executive Board held later, the following were elected as officers of the Confederation for 1948: *President*, Dr. T. Howard Butler; *Hon. Treasurer*, C. E. Carey; *Chairman of the Executive Board*, R. Alsop; *Vice-Chairmen of the Executive Board*, Dr. E. V. Evans, S. Billbrough.

The Executive Board consists of 10 representatives nominated by each of the Association of Tar Distillers, the British Association of Coke Oven Tar Producers, and the British Gas Council, and they are as follows:

Association of Tar Distillers—S. Billbrough, C. E. Carey, E. Hardman, C. Lord, Wm. McFarlane, S. Roberts, Stanley Robinson, Major A. G. Saunders, L. Shuttleworth, W. A. Walmsley. *British Association of Coke Oven Tar Producers*—R. Alsop, A. Bradbury, R. Crichton, W. J. Dobson, C. F. Dutton, G. A. Hebden, Captain C. F. Ward Jones, Sir Walter Benton Jones, Captain T. H. Thorneycroft, A. Watson. *British Gas Council*—S. Black, Dr. E. V. Evans, A. L. Higham, W. K. Hutchinson, D. D. Melvin, C. M. D. Belton, H. E. Bloor, Colonel W. Moncrieff Carr, P. G. G. Moon, Colonel H. C. Smith.

The five last-named representatives of the British Gas Council have been nominated by the Association of Co-operative Tar Groups.

PROGRESS IN CO-OPERATIVE GRASS DRYING

COKE PLAYS AN IMPORTANT ROLE

THE experiment in communal grass drying undertaken by the Milk Marketing Board, in collaboration with Imperial Chemical Industries, Ltd., at Thornbury, Gloucestershire, to which brief reference was made in the annual report of the British Sulphate of Ammonia Federation ("JOURNAL," Jan. 7, page 53), is a noteworthy instance of the service the Gas Industry, more particularly on the coke side, is able to render to agriculture. In some instances gas has been employed as the heating medium, with very great success, but in the vast majority of plants, of which that used in the Thornbury experiment is typical, gas-works coke is the fuel employed. It is the most suitable fuel for the purpose, as freedom from smoke and absence of volatile constituents in the products of combustion ensure that the dried material is entirely free from any contamination.

The importance of grass drying lies in the feeding value of the product. In the past grassland has been used principally for grazing and producing hay for winter feeding, but hay is of such low feeding value that it has to be supplemented with expensive concentrates. Young grass properly dried retains in a natural state practically the full food value and health giving qualities of fresh grass and can therefore during the winter, and without supplement, fatten stock and supply the requirements of high-yielding cows, keeping them healthier than with hay and concentrate. The benefits which acerue from the production of artificially dried grass may be summed up as follows:

Feeding Value. Dried grass made from short young grass is equal or almost equal to cattle cake and concentrate. All dried grass is practically equal in value to the fresh grass from which it is made, and is a complete winter feed which does not need to be supplemented with cattle cake or other concentrated feeding stuff.

Vitamin Value. Dried grass contains almost the full carotene and vitamin value of fresh grass. This keeps animals fit and free from ailments.

Cash Value. With a modern and well-managed grass drying plant the cost of production of dried grass is only about 60% of the cost of purchased cattle cake and concentrates of equal feeding value.

The I.C.I. Mark 3 dryers, coke fired, installed at the Milk Marketing Board's co-operative grass drying plant at Thornbury, Gloucestershire.

Saving Crops in Wet Weather. Grass can be cut and dried in wet weather although the output of the dryer is lower. During a wet hay harvest if a grass dryer is available the hay can be gathered, put quickly through the dryer and saved in good condition. Grass drying is therefore a form of insurance against a wet hay harvest.

Individual and Co-operative Plants

Progress in grass drying in the British Isles since 1935 has been almost entirely on the lines of individual farm drying plants. The number of plants installed prior to the war was governed by the capital cost of the equipment, which in 1939 was a little under half present-day costs. During the war the supply of grass dryers was severely restricted by the low steel allocation for this purpose. Individual farm drying plants produce from 2 to 4 cwt. of dried grass per hour when drying grass of normal moisture content, or 4 to 8 cwt. when drying wilted grass. Successful operation is dependent on running the plant to a fixed routine, *viz.*, during the period the dryer is working it must work at full output capacity, and therefore cutting, transport, &c., must be planned so that there is no breakdown in the flow of grass to the dryer when it is in operation; and men must be drilled to operate the dryer from 8 to 12 hours per day at its rated capacity, and it should be planned that the dryer is operated for, say, five days or a week at least once it is started up.

Until the Thornbury scheme was initiated it was felt that there would be great difficulties in operating a central drying plant, due to the fact that such a drying centre could not plan to get a regular supply of grass. Growth on farms would be dependent on the weather, and in dry weather the plant would not get enough, and after a good rainfall the farmers would be clamouring to send in their grass following a flush growth. The method of operating the Thornbury scheme is that the central factory leases from so many farmers around certain acreages of grassland for a given period. The central factory does the fertilizing and field treatment and cuts and transports the grass with its own equipment. Thus by suitable fertilizing, &c., the centre can control the growth of the different farmers' fields to ensure, as far as possible, a steady intake of grass. The farmers can take back the grass dried from their fields with appropriate charges for field management and drying.

An additional advantage of this scheme to the farmers is that the knowledge and experience of the central organization, in the fertilizing, treatment and management of the grassland leased to them, should result in considerable improvement in their grassland resulting in increased yield and quality of grass from their fields.

A Model for Development

The Thornbury scheme is designed to show how far a grass drying service can be organized successfully on a communal basis and how far

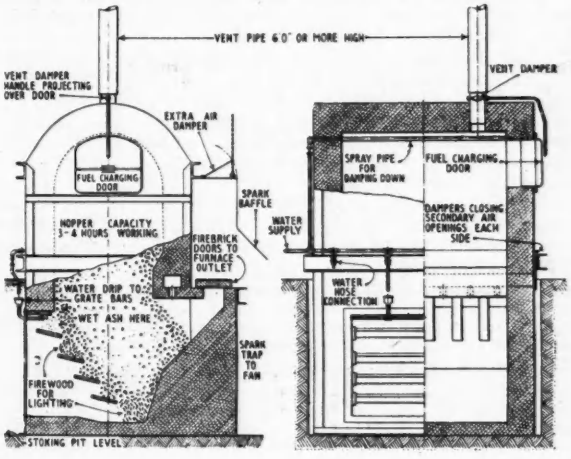


Diagram of the semi-producer type coke fired furnace (Patent No. 494,086) employed in the Thornbury grass drying plant.

modern methods of grass drying can be brought within the range of the small producer. Its success may well lead ultimately to a nation-wide grass drying scheme for small farms. Plans for a larger scheme have in fact been examined, one proposal being for a unit of 10 dryers catering for all the needs of small farms in a selected area.

The contribution of Imperial Chemical Industries, Ltd., to the Thornbury experiment consists of two I.C.I. Mark 3 dryers, with storage barns alongside, and the general arrangement of the layout. The dryers are fitted with London and Counties Coke Association semi-producer furnaces, which use about 350 tons of large coke per annum (from March to September) supplied from the works of the Bristol Gas Company. There is a central machinery pool for harvesting and collection, and from 35 to 40 farmers have joined the scheme, mostly representing units of 60-80 acres. A committee of local producers helps in operating the scheme and discusses technical and management problems.

The furnace of the I.C.I. Mark 3 dryer burns coke to provide hot air for drying. An electrically driven fan draws the hot air from the furnace and delivers it to the underside of four trays on which the grass is laid to be dried. Water is evaporated from the grass and removed as steam by the hot air as it passes upwards through the bed and escapes to atmosphere. To secure uniform drying the grass is dried in batches and subjected to hand tedding when it is nearly dry. This is achieved by loading wet grass on to an outer pair of trays and transferring it to an inner pair of trays when the greater part of its moisture has been removed.

Hot air leaving trays of partly dried grass is less saturated than that leaving the wet grass trays. For this reason all the exhaust air from the inner trays is collected under a movable hood, recirculated to the fan and used for drying a second time. The efficiency of the dryer is greatly increased by this device. Batch drying ensures a uniform product since no grass is delivered from the dryer until it is shown to be dry by the thermometers which control the operation.

It is necessary, however, to work the fan and furnace continuously to achieve maximum efficiency. The dryer is therefore arranged so that one pair of trays are being dried while the other pair are being emptied and refilled with wet grass. The hot air can be instantaneously diverted from one pair to the other by swinging over a valve operated by a large handwheel, and at the same time the movable hood can be moved along rails so that the hot air may be collected for recirculation.

The furnace is of the semi-producer type (Patent No. 494,086). Coke is fed in at the top and a full charge lasts about three to four hours under normal working conditions. Air is drawn in through the water-cooled grate and as it meets the hot coke it forms producer gas which is burnt at the back of the furnace in two flues. A vent pipe with shut-off valve is provided which has to be opened to release any accumulation of gas before the charging door can be opened. The arrangement of the furnace is such that a clean gas is produced and on burning in an excess of secondary air it gives a mixture of drying air at 140-150° C., which can be passed directly through the grass, and can be regulated in temperature by the secondary air-flap.

The fan is a high-efficiency centrifugal machine driven by V-belts from an electric motor or a diesel engine. The mixing chamber serves to collect the hot air from the furnace and also the recirculated air from the dry tray and mix them before they enter the fan. The hot air delivered by the fan is distributed to the four drying trays in such a manner that one pair of trays is working while the other pair is shut off. This is done by means of change-over valves located in the ducting and operated by a common shaft. The lower duct delivers air to the underside of the trays and the upper duct returns to the fan air collected by the hood over the dry trays. The change-over valves are operated by a handwheel located in front of the dryer through a horizontal and vertical shaft connected by a crown wheel and pinion. The air can be diverted from one pair of trays to the other by turning the handwheel through 90 degrees.

The trays consist of perforated plates suitably stiffened and carried in a steelwork enclosure which forms the ducting below the trays and the walls surrounding the grass to be dried. Grass is tedded on to the trays and the hot air delivered by the furnace and fan blows upwards through the grass. The outside pair of trays are used to dry the grass partially; the inner pair complete the drying of the partly dried grass. To keep the wet grass in position and to prevent blowholes from forming, flexible wire hurdles are attached to the wet trays. Inside the movable hood to which eference has also been made is a rigid metal hurdle to hold the dry grass in position.

News in Brief

The Institute of Fuel Building Fund, the appeal on behalf of which was launched last April, reached a total of £18,500 by the end of the year 1947, against the target of £25,000.

A New Gasholder at the works of the Ramsgate Gas Department was officially put into commission on Dec. 15 by the Mayor of Ramsgate, who opened the valve for the gas to pass into the mains.

Following a £10,000 Loss on the gas undertaking last year, Mansfield Town Council is applying to the Minister of Fuel and Power for permission to increase the charges by about 10%. It will be the first increase Mansfield consumers have had since 1936.

Sanction Has Been Received by the Skegness Urban District Council from the Ministry of Fuel and Power for its high pressure gas supply scheme, which provides for future extension into the area occupied by the Butlin Holiday Camp.

Spalding Urban District Council is to make application to the Ministry of Fuel and Power for sanction to borrow £10,453, the cost of laying 7,700 yards of 6 in. high pressure main for a bulk supply of gas to the Long Sutton and Sutton Bridge Gas Company.

The Mavitta Drafting Machines, Ltd., report that their recent move from their old premises in Aston to Highlands Road, Shirley, Birmingham, was accomplished with smoothness and speed. The new, up-to-date, commodious factory will aid in maintaining the ever-increasing tempo in the production and efficiency of their drafting machines.

The Midland Warehouse of the British Aluminium Co., Ltd., at 17-18, Providence Street, Cradley Heath, Staffs, is now in full operation. The telephone number is Cradley Heath 6881. The Company's Midland Branch Office remains at Lansdowne House, 41, Water Street, Birmingham, 3. (Telephone No.: Central 3053. Telegrams: Britalumin, Birmingham.)

The Dismissal of Summonses against four boys who appeared at Smethwick Juvenile Court for damaging street lamps by throwing stones is likely to have a sequel. Smethwick Town Council is being recommended to instruct the Town Clerk to obtain the opinion of counsel with a view to asking the magistrates to state a case for submission to the High Court.

The Homecraft Course recently held in the Demonstration Theatre of the Nottingham Gas Department, proved very successful. There was an average attendance of 84 at each of the 10 meetings, many requests being received for a "follow-on" course which will be arranged next autumn. Mr. R. M. Wilkinson, Engineer and Manager, opened the course which was arranged by Mr. Edmund Bates, Sales and Service Superintendent.

"Parsimonious" was the description applied by a member of Brigg (Lincs) Urban District Council to the Gas Committee's proposal to offer a 10s. reward for any information as to damage done to the town's street lamps. He suggested that either the reward should be increased or the Committee should rely on the public spirit of the ratepayers, and the Council agreed that the Committee should be asked to reconsider the matter.

Before the Lord Provost of Edinburgh, Sir John I. Falconer, retired from office, his last public engagement was to open the "Home Safety" Exhibition in Edinburgh. Sir John was very interested in the gas appliances exhibited by the City of Edinburgh Gas Department, as they were especially chosen to emphasize "safety first" in the home. As a particular example, the safety features incorporated in the latest New World Gas Cooker No. 1430 were shown to the Lord Provost.

A Preview of Films was arranged by Mr. Walker, the Harrogate Area Manager, in order that teachers from the various schools in the Harrogate Gas Company's area of supply should have some idea of the films which are available for presentation to the scholars. The films shown were "The Nation's Wealth," "On Silent Service," "Transference of Heat," "Manufacture of Gas" and "It Comes from Coal." The Head Teachers' Association was represented by many teachers who expressed their appreciation of the excellent educational value of the films, and emphasized that a preview of such films enabled them to choose subjects which would be most suitable to their scholars.

CHRISTMAS AND NEW YEAR PARTIES

The Hull and District Branch of the Women's Gas Council held a New Year's Party in the demonstration room of the East Hull Gas Company on Jan. 7. Some 55 members attended. The afternoon opened with a beetle drive, followed by party games. Tea and prizes were provided by the Committee.

* * *

The third annual staff social of the Coventry Gas Department was held at the Geisha Cafe, Coventry. Mr. J. E. Wakeford, Engineer and Manager, and Mrs. Wakeford, together with approximately 100 members and friends, spent the evening in dancing and social activities. Owing to the catering restrictions, the usual dinner was replaced by an interval buffet supper.

* * *

The management of Ascot Gas Water Heaters, Ltd., entertained 1,500 guests from the Neasden Works and Head Office at Christmas time when the real party spirit was much in evidence and a good time was had by all. Dancing and a cabaret contributed the main source of entertainment and everybody was true to the time honoured Ascot tradition of work hard and play hard. Mr. F. P. S. Stammers (Executive Director), the Earl of Limerick (Chairman), Mr. W. O. Nunn (Personnel Manager), and Mr. R. J. Gregg (Sales Manager) distributed the prizes won during the evening.

* * *

The seventh annual dinner for staff and foremen of the Coventry Gas Department was held at the Foleshill Works Canteen under the Chairmanship of Mr. A. E. West, Deputy Engineer and Manager. Guests included the Chairman of the Gas Committee, Alderman J. Howat, and the Vice-Chairman of the Gas Committee, Councillor H. Stanley. The toast of the Gas Industry was proposed by Alderman Howat and replied to by Mr. J. E. Wakeford, Engineer and Manager. The toast of the staff and foremen was proposed by Councillor Stanley and replied to, on behalf of the staff, by Mr. J. Swan, Chief Administrative Assistant to the Gas Department, and on behalf of the foremen by Mr. J. Garner, Mains Inspector.

Referring to nationalization, Mr. Wakeford said that the same team spirit that had been particularly prevalent since 1945 and which had promoted the Department's rapid expansion and attendant good service to the consumer would, he knew, continue. The same spirit of service to local government would still prevail, whether the Department was controlled by the local authority or by the national body. He assured the Chairman of the Gas Committee of the continuance of co-operation between the Gas Committee and Management.

DEVELOPMENTS IN THE PRODUCTION AND MEASUREMENT OF CONVECTED HEAT FOR DOMESTIC PURPOSES

By A. R. BENNETT, M.Sc., Assoc. M.Inst.Gas E.,

Research Manager, Radiation, Ltd.

(*Abstract of Publication No. 324 of the Institution of Gas Engineers, presented at the Autumn Research Meeting, 1947*)

IN Great Britain there has been during the past few years a steady revival of interest in convective heating. This development has been stimulated by the gradual worsening of the general fuel position, necessitating an intensification of the drive for higher thermal efficiencies in heating appliances.

The economic aspects of convected heat have received much attention during the past few years, but this has not always been related to the ultimate objective of heating practice. It is evident from past experience that many people have set out to solve heating problems without any clear realization of their objective. An answer in terms of equivalent temperature of a heated environment is only half the story. The sole aim of any domestic heating process is to secure the maximum degree of comfort for the occupants of a room, and this can be defined only in terms of physiological and psychological considerations. The most economical system is not, therefore, necessarily acceptable in terms of ultimate objective.

Despite all the investigations which have been carried out in this country and abroad on the basic requirements for house heating, the situation remains that we are still without comprehensive data on the relative merits of alternative systems. In the present state of knowledge, the basis of the case for convected heat is primarily economic, for under normal domestic conditions fuel can be burnt at a higher overall efficiency if the resulting heat is acceptable partly or wholly in convected form. For the present the utilization of convective heat is essential if we are to make the most of our limited thermal resources. In addition to the economic aspect, the experiments of M. Fishenden and R. E. Willgress led to the conclusion that when air temperatures fall below about 46° F. it is impossible for sitting persons to obtain comfort with radiant heat only. Under such conditions a proportion of convected heat, provided it is not associated with an unduly low humidity or with odours arising from charring of dust, &c., can undoubtedly contribute to comfort. Furthermore, heating by a correctly designed and installed convector system is less localized than in the case of a high-temperature radiant source, and the heating of the whole of a room or dwelling to a comfortable temperature permits of free movement of the occupants and more effective utilization of the available space. It enables architecture to be of the more open type which, it is claimed, has psychological benefits in giving a greater feeling of spaciousness and freedom.

Comparisons of different heating systems have in the past been largely concerned with the economics of maintaining a given equivalent temperature rather than with the assignment of a figure of merit on the basis of the degree of comfort of the occupants of the space concerned. Efforts have been made from time to time to develop objective standards of comfort, but the inter-relation of the relevant factors (temperature of air and environment, air movement and humidity) is too complex to permit of reproduction by physical means. Consequently, we still have to rely ultimately on individual reactions in assessing the merits of a given heating situation, with the result that traditional practice and national or regional prejudices enter largely into our judgments. We must, however, continue our efforts to establish comfort standards on a factual basis and ensure that appliance development is directed with such standards in view.

While, for traditional and other reasons, the progress of domestic heating by convection has been retarded in Great Britain, there is little doubt that the use of gas for this type of heating has been further handicapped by the unsatisfactory design of some of the early convector appliances, which discharged products of combustion into the room in considerable amounts, and presented heated surfaces on which dust could be deposited and charred. The effects of high chimney suction on the thermal output of these appliances were, also, frequently such as to result in a very low installed efficiency.

These observations emphasize the need for a detailed study of the basic principles, to ensure that these and other possible pitfalls may be avoided in modern appliance design, and that the desired thermal output be attained with a minimum of structural complication.

One striking fact about the subject of heat transfer by convection is that, despite the number and variety of the investigations on record, no generally applicable underlying theory has been developed; hence, results can be systematized only in terms of empirical formulae of limited application. As pointed out by C. H. Lander, there are so many variables that the numerous gaps remaining make it the exception rather than the rule that the knowledge necessary to solve some new problem can reasonably be deduced from any of the empirical formulae.

There are several directions in which the designer of convector heaters is hampered by this lack of a coherent, underlying body of knowledge. While the heat loss from freely exposed plates in air has been fairly fully investigated, the recorded results on the effect of the proximity of heated surfaces to each other on the overall heat loss are scanty and somewhat anomalous. The heat loss from the internal surfaces of a partial enclosure, such as a vertical tube, has received very little attention. Problems in this category force themselves upon the attention when one attempts to design convector heaters on a rational basis.

The direct measurement of convected heat output is necessarily a difficult experimental technique. Conditions of flow in natural convection are often unstable, and in any direct method of measurement the measuring apparatus is liable to introduce appreciable disturbances into the normal working conditions of the appliance under test. As the measurement of radiant-heat loss has been more fully developed, it is considered preferable to measure the radiant-heat output of an appliance together with the flue loss, and obtain the convected heat output by difference. A method of estimating flue loss with rapidity and accuracy has been developed in connexion with this work.

Factors Affecting Heat Output from Convectors

(A) General Considerations

Many of the earlier convector gas fires and similar appliances were open to objection because of the lack of a satisfactory design basis. While modern appliances still have to be designed, to a considerable extent, empirically, a great deal more is now known of the necessary conditions for satisfactory operation.

In designing a convector system, the attainment of the required thermal output is only one aspect of the matter. Consideration has to be given to the exit temperature of the heated air and of accessible surfaces. The heating of dust particles to charring temperature has to be avoided, for air filtration is limited to forced convection systems because of the very small working pressure head available in free convection. Furthermore the method of discharging the air has to be considered in relation to the surroundings of the appliance, to avoid the damage to decorations, &c., which has often been associated with air heating in the past.

In appliances designed to be connected to a flue, the variation in thermal output with chimney suction is a characteristic which must be very carefully watched if the appliance is to be effective as installed. Not only is there a danger, in a faultily designed appliance, of heated air being drawn up the flue, but, also, the increasing dilution of flue gases with increasing chimney suction affects the temperature head and, hence, the heat-transfer conditions in the heat exchanger.

In a self-contained appliance such as a convector gas fire the permissible height severely limits the extent to which the air flow can be "forced" by buoyancy effects. If unlimited head room were available, a marked increase in heat transfer per unit of surface, compared with the "normal" free convection condition, would be possible.* Convector gas fires and similar appliances are normally limited to about 2 ft. in height by conventional surrounds, and it is with the potentialities within this very restricted range that we are at present concerned.

It is evident, in the light of the above remarks, that any air-heating units must be carefully designed from an aerodynamic standpoint to minimize resistance to air flow, and, thus, to secure the required heat output at an outlet temperature not exceeding the charring temperature, while at the same time discharging the hot air stream in the most advantageous manner relative to the space to be heated.

The free convection loss from an exposed surface is limited, and it is not practicable, in the type of appliance under consideration, to provide power-operated means of inducing air flow. One has, therefore, to utilize to the best advantage the thermal energy in the gases to obtain as high a rate of air flow as possible and to combine

* Air velocities of 10 to 20 ft. per second are attainable under ordinary domestic chimney conditions, giving considerably higher heat-transfer coefficients than with a freely exposed surface.

this with heat-transfer surfaces so arranged as to give optimum overall transfer from combustion gases to the air.

In seeking means of maximizing heat output from surfaces, three types of heat-transfer system present themselves as convenient starting points for the investigation:

(*a*) Vertical tubes and plates heated from the inside and exposed freely to the surrounding air on the outside.
(*b*) Vertical tubes heated from the outside and providing free passage for air inside.
(*c*) Arrangements of plane surfaces with substantially free vertical passages for air flow, alternating with combustion gas passages. We include finned surfaces in this category.

Case (*a*) has already been treated authoritatively in the existing literature and does not call for any further elaboration in the present connexion. We shall, however, at a later stage, draw comparisons between the heat-transfer conditions on the inner and outer surfaces of vertical tubes as raising some interesting principles of design.

The experiments and theoretical investigations to be described are, therefore, concerned primarily with items (*b*) and (*c*) above.

Turning to the combustion passages of an appliance, two objectives must be kept in view:

(i) Invulnerability to the effects of varying chimney suction.
(ii) Maintenance of maximum temperature head—*i.e.*, minimum dilution compatible with freedom from condensation at the cooler end of the heat-exchanger, and with the limitations on wall temperatures on the heat-dissipating side of the system.

A satisfactory combustion standard under all working conditions has also to be ensured.

The air flow through a restriction such as a flue nozzle or similar opening is approximately proportional to the square-root of applied pressure difference. On the other hand, in a long, narrow channel in which laminar flow conditions are established the flow is proportional to the first power of the applied pressure difference. If, therefore, a channel and an orifice are connected in parallel to a source of pressure difference, the proportion of the total air flow passing through the orifice becomes progressively less as the pressure difference increases. If the total flow is independently limited by other resistances in the aerodynamic circuit, it is evident that the range of air flow through the orifice is considerably less than would be the case if the source of pressure difference were applied directly to the orifice itself. This principle is the basis of one method of achieving partial protection of the flue passages of an appliance from the effects of chimney pull. In the case of a convector gas fire the parallel duct in which the laminar flow conditions are established can be housed conveniently at the back of the fire.

A more advanced method of reducing vulnerability to chimney pull is based on the following considerations: A fixed aerodynamic resistance can only pass a given air flow at a constant pressure difference. The operative pressure difference is the drop in total head across the system, and not in static head only. If, therefore, the system is so designed that the difference in total head between inlet and outlet be maintained constant, or nearly so, substantially constant operating conditions will be attained, irrespective of whether the static pressure drop is constant or not. The primary flue of the appliance terminates in a suitable relationship to the end of an auxiliary duct in which the aerodynamic losses are minimized. The total head at the outlet is, therefore, substantially equal to that in the room outside the appliance, as the arrangement is such that the kinetic head is recovered and, in effect, imposes a back pressure on the flue outlet which offsets the chimney suction.

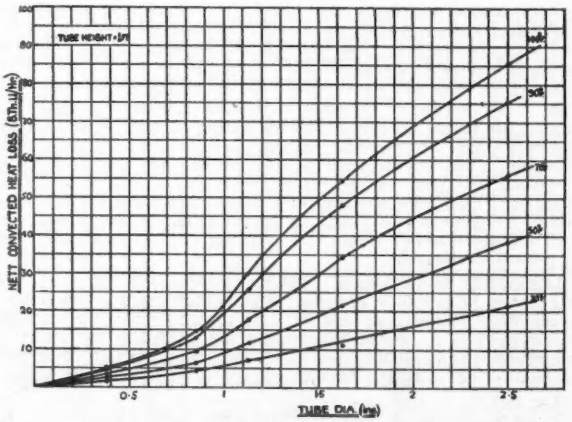


FIG. 1.—*Variation of Convected Heat Loss from Inside Surface of Vertical Tubes in Air*

The maintenance of minimum dilution in the flue and heat-exchanger passages, particularly in the case of an open combustion system such as a gas fire, is a matter calling for very careful aerodynamic design, as quite small pressure differences may lead to excess air entering the system locally. This not only reduces the temperature head available but also increases the volume of gases with which the system has to deal, and thus increases the difficulties of complying with Lancet test conditions.

(B) THEORETICAL INVESTIGATION

It is evident, on general grounds, that, given a limited space in which gas is to be burned and heat is to be released, there will be some optimum arrangement of surfaces within the space giving a maximum heat transfer from the burning gases and hot products of combustion to the air. If there be insufficient surface, the thermal resistances limit the heat transfer. Alternatively, if there be an excess of surface, the resistance to air flow is such that at the available temperature differences the heat capacity of the moving air cannot deal with the required heat output. In practice, the design of appliances is further complicated by a number of manufacturing and other considerations which limit the range of forms which the heat-transfer surface can take. It is, nevertheless, desirable to investigate what arrangement of surface is ideal, irrespective of the constructional difficulties which may be encountered.

The air flow by natural convection through a laterally confined space differs from the free flow adjacent to an exposed heated surface, in that (*a*) growth of the boundary layer on the surface is modified by the proximity of another boundary, and (*b*) mixing of the heated layer with cooler air, which can take place to an unlimited extent around an exposed surface, is strictly limited, and, hence, both the heat transfer and the aeromotive effects are different from those encountered in the case of an external surface.

Because of the chimney effect the aeromotive forces can exceed greatly those causing air flow over a free surface, and the local heat-transfer conditions may, therefore, approximate more closely to those of forced convection. The degree to which the restriction on mixing will affect the conditions will obviously depend on the spacing of the surfaces, as at very wide spacings the free surface conditions are approached. A rigorous analysis covering the whole range of conditions is somewhat complex, but the general character of the phenomena can be illustrated very simply.

Consider, first, the case of a smooth, vertical, heated tube* of radius r in which we allow an air flow to become established by free convection. There will be a substantial region in which the boundary layer conditions approximate to those near the entering edge of a plate in an air stream, followed by a region in which the temperature and velocity gradients are modified by the influence of the adjacent boundary layer.

The analysis of the entry conditions for the case of laminar flow over a plate in the presence of heat transfer has already been accomplished and can be applied directly to the present problem:

It may be shown that the heat loss from one side of a plate of length l and width b is

$$Q = 0.6\, k\, b\, \Delta t \sqrt{\frac{u_o l}{\nu}} \qquad \ldots\ldots(1)$$

where k = thermal conductivity of air.
u_o = mean velocity at entry.
ν = kinematic viscosity of air, all in self-consistent units.

Δt is the mean temperature difference between tube and air, which in the present case must be taken as the log. mean owing to the range of temperature covered. If the excess of tube temperature over outside air is θ_1 then the mean air temperature excess in the tube is $\theta_1 = \Delta t$.

The mean velocity u° at inlet conditions is

$$u_o = \sqrt{\frac{2g}{\frac{l}{l} + \frac{2.656}{R^{\frac{1}{2}} r}} \cdot \frac{\theta_1 - \Delta t}{T_o + (\theta_1 - \Delta t)}} \qquad \ldots\ldots(2)$$

where R = the Reynolds Number based on l as the characteristic length
g = gravitational constant.
T° = inlet air temperature (abs.).

In addition, the heat output Q can be expressed in terms of the outlet air temperature rise θ_2 as

$$Q = \pi r^2 u_o \rho_o S_p \theta_2 \qquad \ldots\ldots(3)$$

where
S_p = specific heat of air.
ρ_o = inlet air density.

The logarithmic mean temperature difference is a function of θ_1 and θ_2, thus

$$\Delta t = \frac{\theta_2}{\log_e \frac{\theta_1}{\theta_1 - \theta_2}} \qquad \ldots\ldots(4)$$

We therefore have four equations (1), (2), (3), and (4) from which the four unknowns Q, u_o, Δt, and θ_2 can be determined. The solution is most conveniently effected graphically.

The above hypothesis assumes that the entering air is non-turbulent and that laminar conditions of flow persist throughout the system. The validity of this assumption is discussed in greater detail below.

* The shape of the cross-section does not alter the principles involved, but for purposes of illustration the tube is assumed to be circular.

In comparing the above hypothesis with results of experiment, one would expect that the range of conditions represented would be limited by two main considerations. In the aeromotive force calculation it is assumed that the temperature is uniform across each horizontal section of the tube, but this is not the case except when $\frac{1}{r}$ is large. However, it is the integrated effect of density differences over the whole height of the tube that is effective in establishing the flow, so that the mean inlet velocity is probably represented fairly accurately. This does not, of course, guarantee that the boundary layer conditions are also correct. Secondly, the Reynolds Numbers used in the above calculation are based on distance from the entering edge as the characteristic length, and not on tube diameter. This range of Reynolds Numbers corresponds to laminar flow in all cases here considered. If the Reynolds Number be expressed in terms of diameter, the critical range is approached in the larger tubes examined, but two factors render it reasonably certain that the flow is nevertheless non-turbulent.

(1) Near the entry to a tube the normal velocity distribution has not had time to establish itself, and if the flow originates in a region of still air the turbulent regime will not establish itself within many diameters distance of the entry.

(2) The rising air temperature causes expansion and, therefore, acceleration of flow, and this tends to suppress any turbulence which may be generated within the system.

(c) Experimental Results

Even in a relatively simple system such as a heated vertical tube a considerable number of variables have to be considered. Apart from the thermal characteristics of the air, the heat transfer is a function of

(*a*) Tube diameter; (*b*) tube length; (*c*) tube temperature; (*d*) ambient air temperature; (*e*) entry conditions; and (*f*) surface roughness.

Similar factors enter into the problem of heat output from parallel vertical plates, with the additional complication that one or both plates may be heated and the space between the plates may be open or closed laterally.

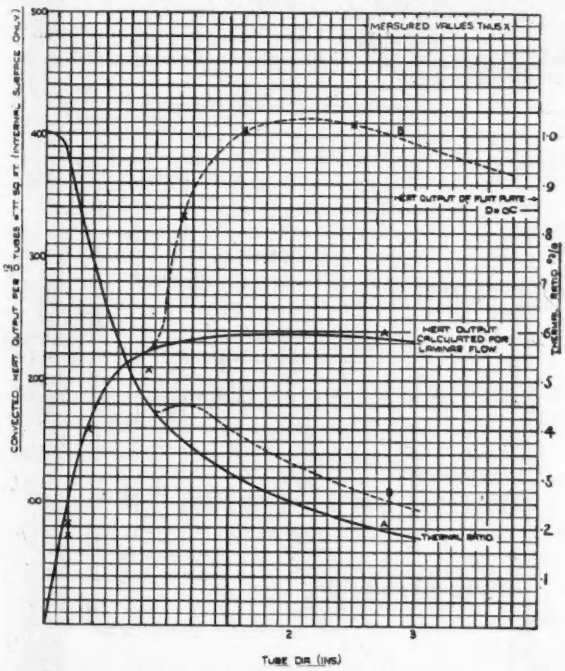


FIG. 2.—*Thermal Characteristics of Heated Vertical Tubes* 1 *ft. high at* 100° *F. Temperature Excess*

To deal comprehensively with all these factors would require a very extensive series of experiments. In the present instance the author's main concern was to determine the range of applicability of the theoretical relations outlines in the foregoing sub-section. The majority of the measurements were taken on electrically heated tubes, as the rate of heat dissipation can be measured conveniently with considerable accuracy by electrical means. Some of the results were cross-checked by tests on water-jacketed tubes, the flow and temperature change of the water being used as a measure of heat dissipation. The accuracy attainable by this method is not as high as when the electrical method is used. Other results were cross-checked by measuring the cooling rate, in air, of tubes previously heated to a suitable temperature. In all cases the heat loss from the internal surfaces was obtained by difference between series of observations with the ends open and closed. The principal series of results obtained on tubes of 1 ft. height is summarized in Fig. 1, showing the effect of diameter and temperature excess. The data can be interpreted in several ways, two of which are of particular importance in appliance design:

(*a*) Where the width of the appliance is limited, but the forward projection is of secondary importance, one needs to know the heat output per tube bank of a given width. The same physical limitations are met with in determining the optimum number of fins on a plate where the ratio of fin height: spacing is to remain substantially constant.

(*b*) Where both width and forward projection are limited, the heat output per unit area of horizontal section of the system is of importance. As in case (*a*) the same considerations can be applied to the finning of a surface or surfaces within a limited space.

Figs. 2 and 3 illustrate the application of some of the basic data of Fig 1 to the above two cases. In practice, a proportion of the available space is lost because of the finite thickness of the tube walls and sometimes due to the interspersing of combustion passages. In the case of finned surfaces, the necessary fin thickness for adequate strength and thermal conduction must also be taken into account. Figs. 2 and 3 should, therefore, be taken as merely illustrative of methods of interpreting the results, and not of direct application to any particular practical case.

Agreement between theory and experimental is satisfactory up to a tube diameter of the order of 1 in., above which the measured heat output exceeds that calculated on the laminar-flow hypothesis by as much as 75%. It may be noted that the optimum tube diameter occurs in approximately the same position on both theoretical and experimental curves, in spite of the difference in absolute magnitude of the results. The same data expressed per sq. in. of cross-section in Fig. 1 show an optimum diameter in the region of 0.3 in., and in this range agreement between theory and experiment is reasonably satisfactory.

The effect of tube height on output depends on tube diameter. In the case of very small tubes in which the air reaches tube temperature at a relatively short distance from the entry, an increase in height may actually decrease the overall heat output. At the other end of the scale, the effect of height will obviously approximate to the well-known relationships in the case of freely exposed plates. The magnitude of increase also depends on the temperature conditions, as the mass air flow through the tube reaches a maximum when the mean internal density is approximately half that of the ambient air. This limit is, however, well outside the range of conditions encountered in the type of appliance with which the Author is concerned. In the case of tubes of practicable dimensions at temperatures in the working range, an increase in height is always advantageous and sometimes markedly so. Taking as a basis of comparison a 1 in. tube 1 ft. high at 100° F., doubling the height will increase the heat output by about 65%.

Within the same limitations an increase of tube temperature excess produces a more than proportionate increase in heat output. Over the range of conditions covered by Fig. 1 the heat output increases as the 1.12 power of the temperature excess. This is somewhat less than would be predicted by the theory which approximates closely to the $\theta_{5/4}$ law which applies generally to natural convection phenomena.

A parallel series of experiments has been undertaken by Mr. E. H. Dock, using arrangements of flat plates, one of which was heated electrically, the other being free to assume a temperature dependent on the heat transfer across the intervening space. These experiments are not yet completed, and it is not proposed to quote quantitative data. The general character of the phenomena are, however, similar to those observed in the case of vertical tubes; and in the case of plates from 6 to 24 in. in height there is evidence of an optimum spacing at which the heat transfer is somewhat higher than in the case of the freely exposed plate. The enhancement in heat output is slight, amounting at the most to about 10%. The results are consistent with those recorded by L. G. Carpenter and H. C. Wassell, who heated both plates and recorded a maximum increase of the order of 25% over the results attained at infinite separation of the plates.

In the present series of experiments no marked difference in behaviour has been found due to opening or closing of the lateral edges of the space between the plates. The power law connecting heat output with temperature varies with the dimensions of the system, and it does not seem practicable to represent the whole range of the phenomena by any single set of equations. The indications are that there are at least two ranges which need to be treated separately, the point of separation of the two boundary layers defining the condition at which the change in regime occurs. It is hoped to publish a more comprehensive discussion of the phenomena at a later date.

Measurement of Convected Heated Outputs

In undertaking work on the development of convector appliances, the choice of reliable and rapid methods of test is obviously an important factor in determining rate of progress. It is evident, from the form in which the heat output occurs, that the direct measurement

of convected heat from a surface or from a complete appliance calls for considerable refinement of technique and is not a measurement that lends itself to rapid or routine application. Conditions of flow degree of accuracy. The flow conditions of the water stream to which the heat is transferred can be readily adjusted according to circumstance to give a temperature rise of convenient magnitude for measure-

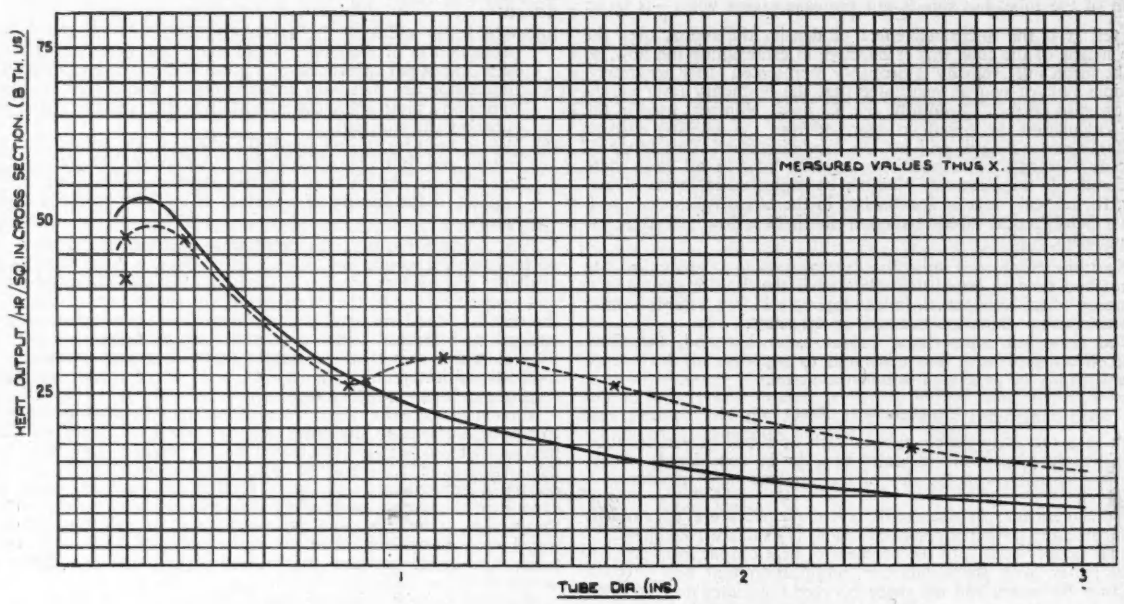


FIG. 3.—*Thermal Characteristics of Heated Vertical Tubes* 1 *ft. high at* 100° *F. Temperature Excess*

in natural convection are extremely sensitive and it is, therefore, difficult to introduce measuring apparatus without considerable danger of disturbing the normal working conditions of the appliance. On the other hand, the technique of radiant heat measurement is well developed, and the flue loss is much less sensitive to interference than is the convected heat output. As a general principle it is, therefore, preferable to make the two latter measurements and to obtain the convected heat output by difference.

The measurement of radiation emitted by domestic appliances is outside the scope of this Paper, but the technique employed in the Central Laboratories of Radiation, Limited, has already been described in detail in *Communication No.* 149/46.*

In most currently used methods of determining flue loss, separate measurements of air flow and mean temperature are necessary. Both these measurements raise problems of sampling and averaging which complicate the technique and subsequent calculation. This arises because it is extremely difficult to obtain uniform velocity and temperature distribution in a duct, and when these factors are varying it is necessary to subdivide the duct into zones and to associate temperature and air flow measurements for each zone. By traversing a duct with a Pitot tube-thermo-couple combination, and weighting the readings in accordance with the British Standards Institution publication, B.S. 1042†, a high degree of accuracy is attainable, but the procedure is necessarily cumbersome when large numbers of determinations are required. Other methods of flow measurement (*e.g.*, by venturi or orifice plate) are rather neater, but are not applicable unless a uniform temperature is achieved.

The measurement of CO_2 concentration in the flue, combined with thermo-couple measurements of temperatures, has been very generally used, but under the conditions of operation of most convector appliances, particularly where a high degree of chimney suction is involved, this method is not capable of yielding a high degree of accuracy, because of the very low CO_2 concentrations prevailing.

Any method to be used in research and development on domestic appliances must cover a 10 to 1 range of flow and heat inputs to the flue, varying from very small figures up to 10,000 B.Th.U. per hour and over. Maintenance of a suitable degree of accuracy over the whole range is difficult in any device depending on direct measurements of kinetic head and temperature in the flue.

The above considerations led the author to the conclusion that a calorimeter similar in principle to the familiar and reliable Boys calorimeter, but adapted for use in a flue, would overcome these difficulties. Such an apparatus would absorb the whole heat content of the flue gases as measured above room temperature and record it as a rate of water flow in combination with a temperature rise, both quantities being measurable by simple means and to a high degree of accuracy. The flow conditions of the water stream to which the heat is transferred can be readily adjusted according to circumstance to give a temperature rise of convenient magnitude for measurement. Under steady conditions problems of averaging and sampling virtually disappear.

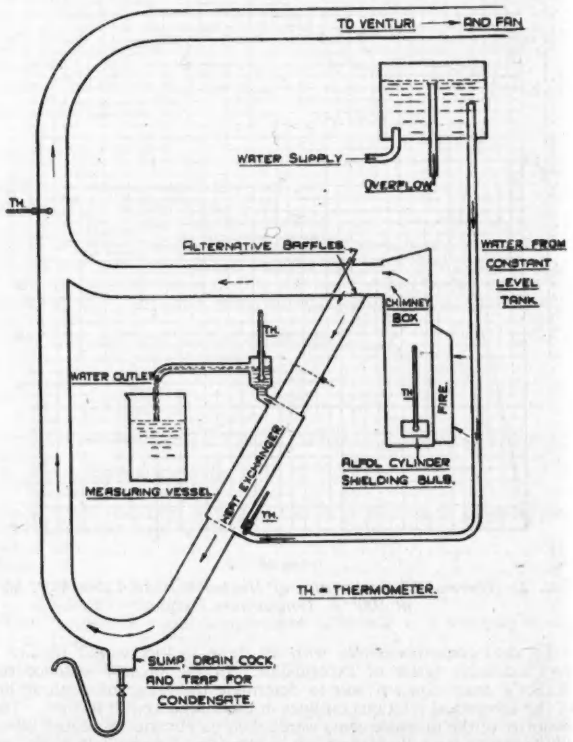
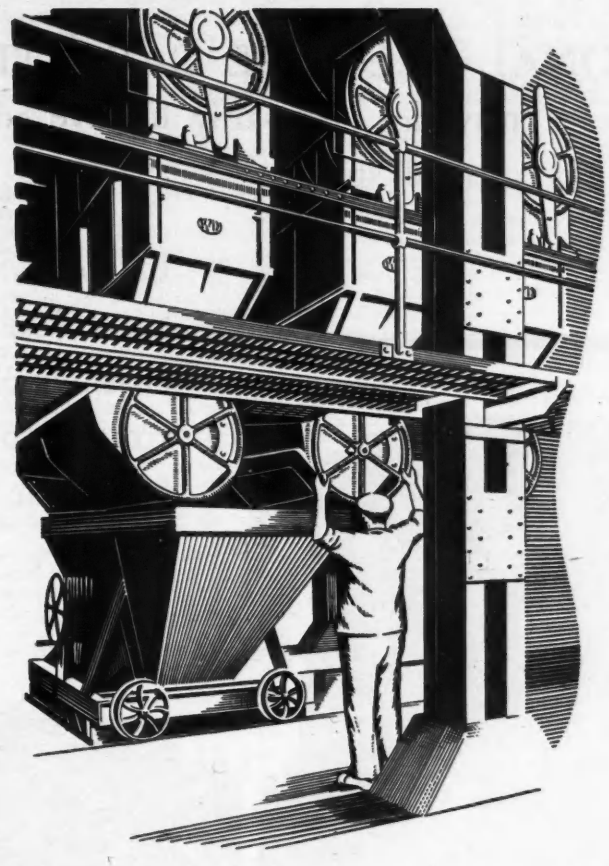


FIG. 4.—*Diagrammatic Arrangement of Flue-loss Calorimeter*

In designing a suitable heat exchanger for this purpose, it was necessary to estimate the amount of surface area required to ensure full heat absorption to the required degree of accuracy while neither making the apparatus unnecessarily heavy nor bulky, nor involving an unduly high pressure drop. During the past decade several compact

* An Integrating Method for the Measurement of the Total Radiation Emitted by Domestic Heaters. Bennett, A. R., and Hartley, H. *Trans. Inst. Gas Eng.*, 1936-37, 86, 632.

† British Standard Code for Flow Measuremen



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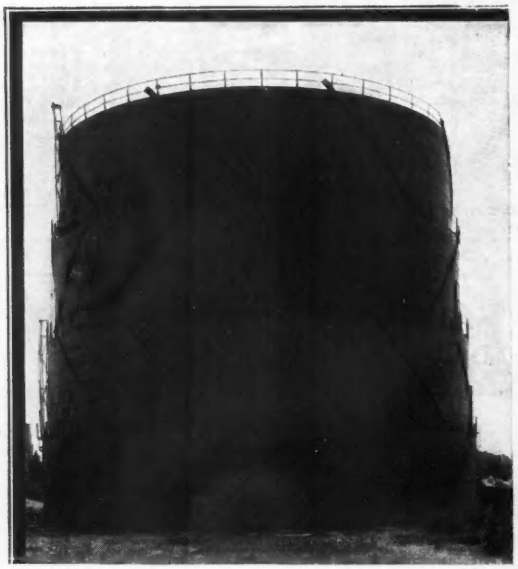

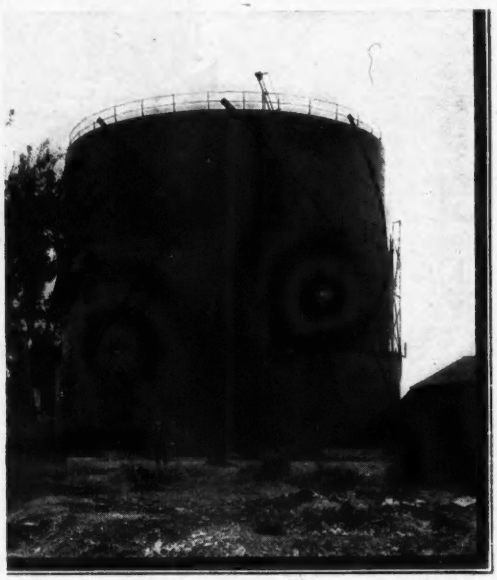

These Gasholders, with capacities of 336,217 and 147,100 cu. ft., replace two single-lift Holders of 95,000 and 50,000 cu. ft. respectively. Thus, the total storage capacity of these two units has been more than tripled without additional ground space, and utilising the existing tanks.

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forms of heat exchanger have been developed for aero-engine-cooling purposes, and their thermal characteristics have been investigated in considerable detail. The range of working conditions being known, the selection of a suitable form of exchanger presented no difficulty. The physical characteristics of the unit now in use are summarized as follows:

Physical Characteristics of Heat Exchanger used in Flue-loss Calorimeter

Outside diameter	6 in.
Overall length	2 ft.
Total airswept surface ..	55.4 sq. ft.
Total waterswept surface ..	51.4 sq. ft.
Total water equivalent ..	7.54 lb. (including contained water)
Mean tube diameter ..	0.2 in. (approx.)
Calculated heat absorption ..	98.5% at 1,000 cu.ft. per hour air flow 96% at 6,000 cu.ft. per hour air flow

As a protection against corrosion by combustion products, all surfaces in contact with the flue gases were tinned. The general layout of the apparatus is shown diagrammatically in Fig. 4, and it will be seen that the necessary surface can conveniently be introduced in the form of a cylindrical exchanger of no greater diameter than the flue pipe itself (6 in.). To facilitate drainage of condensate, the apparatus is so arranged that the flue gases are carried downwards through the heat exchanger, and the condensate trap and measuring vessel are provided at the lowest point in the system. It is neither convenient nor desirable to mount the exchanger direct on the flue outlet, so that, notwithstanding the lagging of the fire opening and ducting, some heat losses inevitably occur between the fire flue and the measuring point. Alternative methods of allowing for this loss have been explored by Mr. U. C. Evans, and by Mr. H. R. Hill and Mr. H. Watts:

(1) Calibration over a range of air flows and the use of a factor.
(2) The use of a sufficiently high air flow through the system to reduce temperatures to a point at which wall losses are negligible. Any desired fraction of this air flow can be drawn through the appliance under test.

When tests are in progress the exchangers abstract both latent and sensible heat, provided the temperature is reduced below the dew-point of the flue gases. The amount of latent heat released must be allowed for when calculating the final result. At normal rates of thermal input to the ducting (5,000 to 8,000 B.Th.U. per hour) we have found it convenient to work to a temperature difference between inlet and outlet water of approximately 16° C. A complete set of readings can be recorded during any 1 minute interval. For greater accuracy, the observations are usually taken in duplicate or triplicate.

Calculation of results:

Where
G = gross heat input.
N = net heat input.
(G = N) = latent heat loss due to uncondensed water.
If L = latent heat represented by water condensed in ducting,
[(G=N)= L] = latent heat unaccounted-for.
If E = heat abstracted by the heat exchangers (observed), and f is the predetermined "efficiency" factor, allowing for heat losses in the ducting, and

$\frac{E}{f}$ = sensible plus latent heat from the exchangers,

then total percentage heat loss $= \frac{[(G-N)=L] \times \frac{E}{f}}{G} + 100$

The value of L is generally an underestimation, on account of the difference in degree of saturation between laboratory air and the cooled flue gases. Ordinarily, this will not exceed 20 B.Th.U. per hour.

A centrifugal fan of adequate power, together with a venturi, are connected to the outlet from the heat exchanger, as shown in Fig. 6, to enable any chosen conditions to be reproduced. A suction of 0.2 in. W.G., giving a flow through an average-sized gas fire of 10,000 cu.ft. per hour, is attainable with the plant described. This amply covers the normal working range, being roughly equivalent to eight air changes per hour in a domestic room of average size (say, of 1,200 cu.ft. capacity).

THE OPERATION OF A GAS FIRED ENAMELLING FURNACE*

By S. E. A. RYDER, B.Sc., A.R.I.C.

THE Company with which the Author is associated has recently installed a modern enamelling plant, including town gas fired box-type furnaces. Each furnace is equipped with its individual gas meter and there are good facilities for carrying out gas analysis and calorific value tests. It is hoped, therefore, that the data to be presented will be of value to members, and that in the near future other enamellers will provide data on other types of furnace, box and continuous, whether heated by gas, oil, solid fuel, or electricity. There is no doubt of the value such information would be to the enameller in checking the performance of his own furnaces and also, when installing new plant, in deciding upon the best type of furnace to suit his particular requirements.

Description of Furnace

The furnace used for the tests described has a 12 ft. by 5 ft. muffle, with a V type bottom. The complete muffle, including V bottom, is constructed of fused alumina tiles. The side walls are 3 ft. high, with a further 2 ft. rise of arch. This muffle height enables hanging or leaning loads to be fired with quite large pieces. The furnace is fired with town gas with a nominal calorific value of 450 B.Th.U. per cu.ft.

There are six burners, three front and three back, firing into horizontal combustion chambers running the full length of the furnace, front to back, the V tiles of the muffle bottom forming the roof of the combustion chambers and also acting as landing walls for the load. The hot gases from the combustion chamber pass up the side walls and over the roof of the muffle to the waste gas flue.

The burners are of the air blast type, air being provided at a pressure of 1 lb. per sq. in. by a 6 h.p. blower. All the air for combustion is provided by the blast, and there is no secondary air supply. The burner consists of a central throat through which the air is blown and a gas supply mounted on the side and connected to the throat.

There is a governor on the gas supply which reduces the gas to zero pressure. The gas is drawn into the burner by the suction produced by the blast. If, therefore, the blast fails for any reason, no gas passes into the combustion flues. Each burner is provided with an adjustment on the gas supply to enable it to be set for the correct air/gas ratio and once this has been done, no further adjustment is necessary.

The maximum gas rate to the furnace, with all burners full on, is approximately 6,800 cu.ft. per hour. Due to the fact that the gas is governed down to zero pressure and is inspired into the furnace by the air blast, the gas rate is nearly independent of the pressure on the main. Even when there is only a few tenths water gauge pressure on the gas supply main, the furnace gas rate falls only about 5%.

The furnace is well insulated, the temperature of the sides, back, and top averaging approximately 100° F. above air temperature. Insulating brick, insulating powder, and asbestos pads are used for insulating The outside of the furnace consists of $\frac{1}{4}$ in. plates carried on 6 in. by 3 in. buck stays. There is a damper in the waste gas flue. The operation of the damper does not affect combustion air in any way, since this all comes from the blower, and movement of the damper has no effect on the appearance of the flames. The damper setting does affect the amount of excess air drawn in through lighter holes, &c., and it has a considerable effect on the muffle atmosphere. Too close a damper setting throws back pressure on to the combustion flues and products of combustion are then forced into the muffle.

Temperature Control

The furnace is provided with two chromel-alumel thermocouples in a single sheath projecting through the rear wall, and connected by a double run of compensating lead to an instrument panel which houses two separate instruments, the temperature controller, and the temperature recorder.

The controller operates through a motorized butterfly valve on the air line between the blower and the burners. When the furnace is up to the pre-set temperature the butterfly valve closes and the only air then passing to the burners is through a by-pass, which passes sufficient air to inspire about 1,400 cu.ft. of gas per hour. There is a meter on the 6 in. main to each furnace. The meters are of the orifice type.

It has been mentioned that each furnace is provided with a temperature recorder. While it is general practice for box-type muffles to have a temperature indicator, it is less common to find recorders in

* Paper presented at the 13th Annual Conference of the Institute of Vitreous Enamellers, Nov., 1947.

operation, and the author would like to stress the usefulness of such an instrument, provided it has a chart with a good open scale. No difficulty is found in identifying each load entered on the fuser's work sheet against its record on the chart, and temperature and time of any load can be checked. This record is found to be of the greatest value as a check on faulty fusing. If the recorder is to be used in this way it must be kept in first class order, and the zero of the recording and control instruments must coincide.

Fuel Economy

Everyone engaged in vitreous enamelling nowadays will appreciate the value of fuel economy. Good furnace practice with any fuel calls for burning the fuel with as near as possible the theoretical quantity of air, and with town gas firing this is very nearly attainable. The ocal town gas gives an ultimate CO_2 percentage for dry waste gas of 12.9 average. The normal waste gas figures on the furnace used in the tests to be described are regularly 11.5 to 12.3% CO_2 with 2.0 to 0.8% O_2. The maintenance of a good waste gas figure calls for regular waste gas analyses, but with present day prices of fuel this is well worth while. In one of the test runs to be described later, the burner and damper settings were slightly mal-adjusted to bring the waste gas analysis down to 8.5% CO_2. This means that for every cu.ft. of gas consumed nearly 2 cu.ft. excess air was passing through the furnace and was absorbing 50 B.Th.U. to heat it up, or more than 10% of the available heat. This is a condition which can quite easily arise on a furnace if regular waste gas analyses are not carried out. Under these conditions the amount of gas consumed was increased by approximately 10%, and this would probably mean £500 per furnace on a year's working. The small amount of labour involved in waste gas analyses is, therefore, well worth while.

TABLE I.—*Flue and Muffle Gas Analyses*

Gas rate (cu.ft. per hour)	Damper setting	Orsat flue analysis %			Orsat muffle analysis %		Gravimetric muffle analysis %		Enamelling conditions
		CO_2	O_2	CO	CO_2	O_2	H_2O	CO_2	
6,900	3/10 closed	12.1	0.7	Nil	0.8	19.2	2.67	0.9	—
6,800	5/10 closed	12.5	0.3	Nil	3.4	15.9	4.25	3.2	Good Fair

The maintenance of low excess air conditions calls for careful setting of the damper and it has been mentioned that if the damper is set too close, back pressure is thrown on to the combustion flues, and products of combustion will be forced into the muffle. This will occur although the muffle is in good condition. Regular muffle atmosphere analyses should accompany waste gas analyses. If the damper is set too close, the muffle atmosphere may easily deteriorate to 5% CO_2 which will probably cause scumming on the ware.

It has been found that a muffle atmosphere of 2.5% CO_2 does not cause scumming, but to be on the safe side a maximum of 1.5% CO_2 should be aimed at, and under these conditions no difficulty is experienced in maintaining about 12% CO_2 in the waste gases.

A portable Orsat apparatus is used for waste gas and muffle atmosphere analyses, and periodically the latter are also checked by gravimetric analysis, drawing a sample of the muffle atmosphere through weighed absorption vessels packed with calcium chloride and "Carbest" to absorb H_2O and CO_2 respectively. Typical analyses are given in Table I.

TABLE II.—*Summary of Test Results*

Test No.	1	2	3	4	5	6	7
Duration of test (hours)	8	8	4	8	8	4	8
Type of load	Flat (ground coat)	Flat (ground coat)	Hanging (ground coat)	Flat (cover coat)	Flat (cover coat)	Hanging (cover coat)	Flat (ground coat)
No. of loads fired	56	116	40	56	125	44	56
Average sq. ft. per load	42.7	41.8	73.4	41.8	39.2	72.0	42.5
Average hourly throughput (sq. ft.)	299	607	734	292	612	792	298
Total area fired (sq. ft.)	2,389	4,858	2,936	2,339	4,893	3,170	2,380
Total weight fired (lb.)	4,072	8,320	4,960	4,812	8,301	5,324	4,176
Wt. ratio (load/perrets)	1 : 2.74	1 : 2.94	1 : 1.58	1 : 2.65	1 : 2.85	1 : 1.58	1 : 2.68
Gas used during test (cu.ft.)	31,914	42,716	25,436	28,637	39,211	22,840	35,441
Gross c.v. of gas	467.5	475	454	468	476	458	458
Muffle temperature	870° C.	870° C.	870° C.	830° C.	830° C.	830° C.	870° C.
Perret temperature before re-entering furnace	293° F.	602° F.	467° F.	285° F.	601° F.	451° F.	293° F.
Flue gas analysis CO_2 (%)	12.1	11.9	11.8	12.0	12.5	11.8	8.5
Flue gas analysis O_2 (%)	1.4	1.7	2.0	1.7	0.9	1.7	7.0
Flue gas temperature	799° C.	804° C.	802° C.	780° C.	785° C.	791° C.	784° C
Gas consumption per load (therms)	2.66	1.75	2.89	2.39	1.49	2.38	2.90
Gas consumption per 100 sq. ft. (therms)	6.26	4.17	3.94	5.73	3.83	3.30	6.82

Results of Test Runs

A number of test runs have been made on the furnace when fusing sheet iron, to ascertain what can reasonably be expected from the furnace and the most economical operating conditions, bearing in mind the relative costs of labour and fuel.

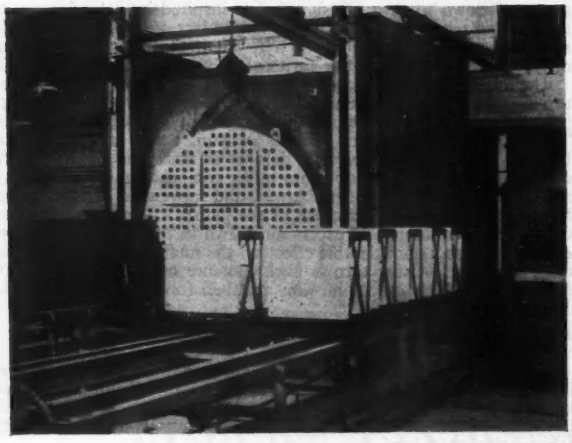

FIG. 1.—*Hanging Perrets*

FIG. 2.—*Leaning Perrets*

The results of the following test runs are presented:

(1) Fusing ground coat, flat loads, throughput 300 sq. ft./hour.
(2) Fusing ground coat, flat loads, throughput 600 sq. ft./hour.
(3) Fusing ground coat, hanging and leaning loads, 750 sq. ft./hour.
(4) Fusing cover coat, flat loads, 300 sq. ft./hour.
(5) Fusing cover coat, flat loads, 600 sq. ft./hour.
(6) Fusing cover coat, hanging and leaning loads, 750 sq. ft./hour.

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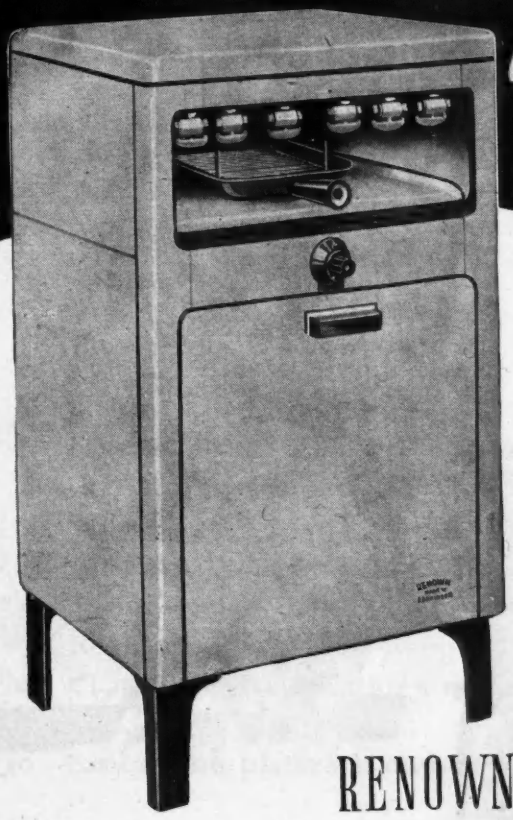

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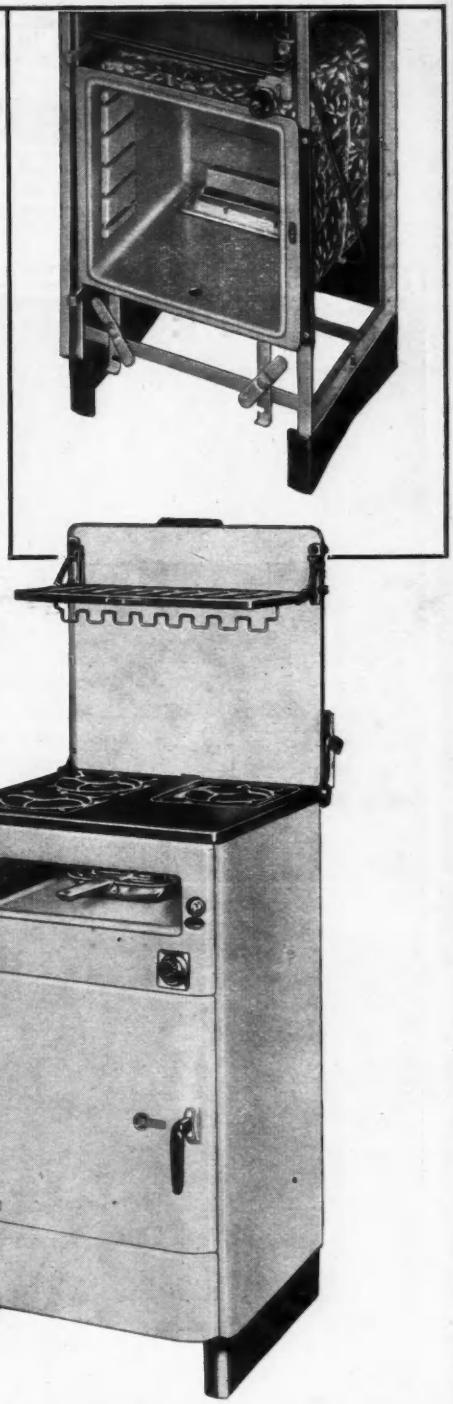

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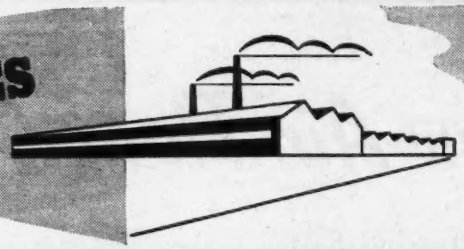

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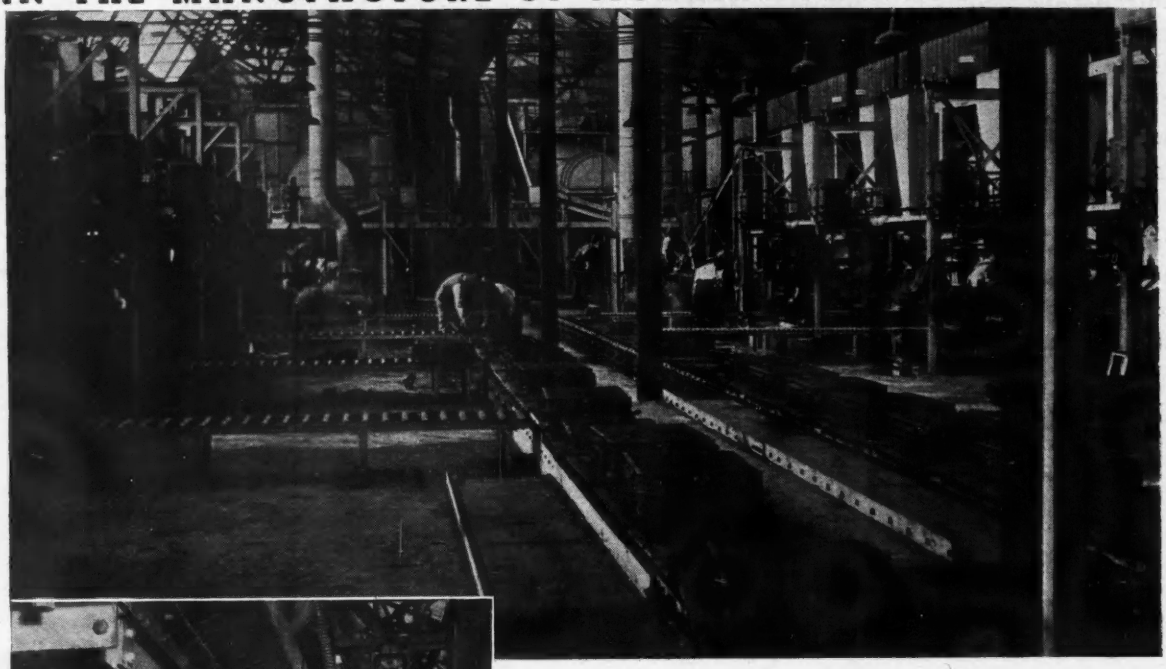

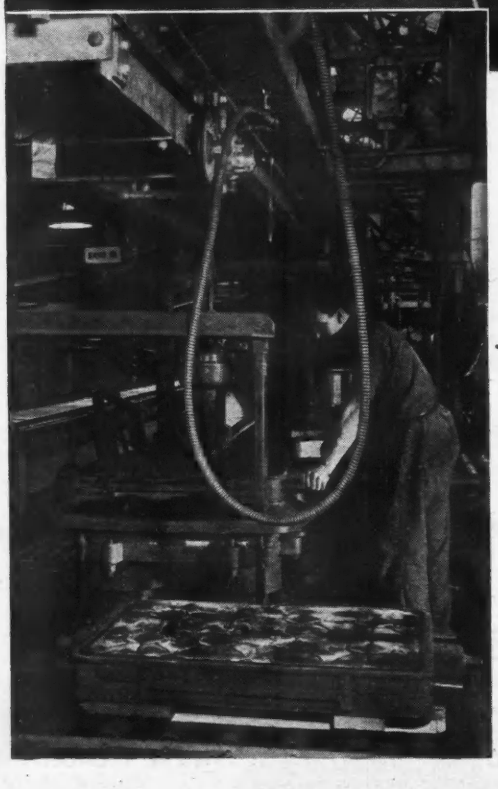

Mechanised Foundry

The installation of the mechanised foundry is part of a programme of improvement to the manufacturing plants of the Firm. • The mechanised foundry—already planned before the outbreak of war—is helping to solve the increasing demand for castings of all kinds, and to overcome the shortage of skilled moulders. • Whilst mechanical moulding has been known to the industry for a number of years, the mechanised foundry is an advance that has resulted in a higher rate of productivity, economy in labour, and a greater uniformity in the standard of castings. • The illustrations show a high, well-lighted airy building equipped with all the machinery—mills, hoppers, and overhead conveyors—for the mixing and rapid handling of the moulding sand. Along the sides of the foundry are located the hydraulic rams which force the sand tightly into the halves of each moulding box. • After these have been securely locked together the complete box is lifted by a mechanical hoist and placed on a moving conveyor which takes it to the cupolas where the molten iron is "poured." Each box stays on the conveyor to a point where it is ejected, and the castings collected for inspection, whilst the sand is returned to the mixers where it is reconditioned for further use.

MAIN

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(7) Fusing ground coat, flat loads, throughput 300 sq. ft./hour with poor flue conditions.

For tests Nos. 3 and 6 hanging perrets were fired on one side of the double forks and leaning perrets on the other side. Normally one would probably not fire this type of load on both forks, but would alternate hanging loads with flat loads. Figs. 1 and 2 show the type of load and perrets employed. The data relating to the tests is summarized in Table II.

The effect of rate of throughput on the heat required per sq. ft. is rather remarkable. The difference in gas consumption between tests 1 and 2 or between 4 and 5 is approximately 2 therms per 100 sq. ft., while if hanging methods are used, the saving may be still more. Heat balances for the furnace under various operating conditions have been worked out and are shown in Table III.

TABLE III.—*Heat Balances for Furnace During Test Runs*

	300 sq. ft. per hour (flat load)	600 sq. ft. per hour (flat load)	Hanging loads	300 sq. ft./hr. 8.5% CO_2 in flue gases
	%	%	%	%
Heat passing into ware	6.5	9.5	10	6
Heat passing into perrets	14	16.5	12	14
Stack loss	48.5	44.5	45	57
Radiation and convection loss through walls and bottom, and through door opening	31	29.5	33	23

A study of this table shows that with a throughput of 300 sq. ft. per hour, for every therm passing into the ware, 15½ therms must be supplied for each one absorbed by the ware. If the throughput is brought up to 750 sq. ft./hour by hanging, 10 therms need to be supplied to the furnace for each one passing into the ware. With poor flue conditions and 300 sq. ft. per hour throughput the figure is nearly 17 therms to be supplied for each one absorbed by the ware.

A study of the furnace record charts for the tests shows that when firing seven loads per hour the furnace temperature drops 50° C. and takes 4 minutes to come back, while when firing 15 loads per hour, the temperature drop is only 25° C. and three minutes are required for recovery. This is because the combustion flues are much hotter in the latter case. The average combustion flue temperature when fusing seven loads per hour (ground coat) is 1,225° C.; when fusing 14 loads per hour (ground coat) it is 1,336° C., and when fusing 10 loads per hour (ground coat, hanging loads) it is 1,316° C. This means that in the latter cases there is a great deal more heat in the brickwork and also since there is a greater temperature difference between combustion chambers and muffle, heat will flow faster into the muffle. Another reason for the quicker muffle temperature recovery with faster firing, is the temperature of the perrets. When fusing seven loads per hour, the temperature of the perrets falls 300° F. lower then when fusing 14 loads per hour. A further factor affecting heat loss is that when fusing 14 loads per hour, the door is opened only once per load, whereas with the lower rate of fusing it is opened twice per load.

It was found that the quality of the ware is definitely better with the higher rate of throughput. Gloss is better and trouble from bits of scale falling on the ware is practically eliminated.

Influence of Loading Conditions

Hanging or stacking allows a much bigger load to be fired than with flat firing (70 sq. ft. per load, against 40), but with a gas rate of 6,800 cu.ft. per hour, only 10 loads per hour of ground coat or 11 loads per hour cover coat can be fused, whereas with flat loads 14 and 16 loads per hour can be maintained.

With hanging loads the furnace temperature drops 80° C. when the load is put in the muffle, against a drop of 25° C. when fusing 14 loads per hour (cover coat) on flat perrets and the furnace takes longer to recover. This is because of the heavier load, cooler perrets, and greater heat loss through the door, which must, of course, be raised much higher. The advantage of hanging loads for increasing throughput may not therefore be as great as may at first sight appear, but this method still offers definite advantages for suitable pieces.

Economic Considerations

It should be borne in mind that a larger thermal input can be obtained on a furnace with town gas firing than with any other form of heating except perhaps oil, and advantage should be taken of this fact and of the rapid temperature recovery which can be maintained over any period. It is obvious from the figures submitted that the faster this type of furnace is worked, the more economical it will be. Both from national and cost points of view, it is essential to get the most out of fuel. In many enamelling plants a fusing rate of about seven loads per hour is common practice and he author suggests that it would be advantageous to see if this throughput can be increased.

It should be remembered that there has recently been an increase of 4s. per ton on coal. This means an increase in the price of industrial gas of the order of ¼d. per therm. While this paper was being written, it was announced that coal prices are to be increased by anything up to 6s. per ton to cover increased freight charges, while a further increase in miners' wages is not outside the bounds of possibility in the next few months. Under present conditions a difference of 2 therms represents about 20d. per 100 sq. ft. per fire, or 5s. to 7s. per hour on operating costs. The advantages of town gas firing for vitreous enamelling muffles are numerous, and the Author is strongly in favour of this fuel for the job. It is, however, a refined fuel, and is not cheap, and unless it is used under the best conditions, the effect on enamelling costs may be serious.

In the plant on which these tests were conducted it was found that with the type of work being handled it was not possible to exceed an average of seven or eight loads per hour with two men working the furnace. For some time now three men per furnace have been used and the fusing rate now averages nearly 11 loads per hour. This includes some hanging loads, which are, of course, slower than the flat loads, and some time is also taken up in changing perrets and in heating up cold perrets. It is found from the charts, that when fusing straightforward flat loads, the fusing rate is 14 to 15 loads per hour.

The average gas consumption for ground coat and cover coat is 4.7 therms per 100 sq. ft. of sheet iron, and is comparable with the consumption figures obtained during the test runs. The cost for gas is 170% of the fusers' wages, when using three men. For economical running a furnace must be worked to maximum capacity and it is unwise to try and save labour if this means that the furnace is not being absolutely fully used. While fuel charges are so much greater than the labour charge, it would obviously be folly to save a little on labour if it meant a large increase on fuel.

When using the furnace to capacity the hourly gas rate is, of course, higher than when working at a lower output, and it might be thought that an average hourly gas consumption in the region of 5,000 cu.ft. is high, but the data presented here shows that the gas consumption does not increase proportionately with the throughput, and a high gas rate does not matter if the work is being produced.

As previously mentioned, in the plant on which these tests were made, each furnace is fitted with its own meter on the gas supply. Such an arrangement is invaluable and the author considers it essential for keeping a close check on the furnace performance and for checking burner settings. The meters used are of the inferential orifice plate type. Such a meter occupies a negligible amount of space and is easy to install. Its cost is about 3% of that of a box-type furnace, or about 2% of the yearly gas bill for a furnace. With the present day price of fuel and the large consumption involved for an enamelling furnace, one cannot afford to be in any doubt concerning the furnace performance, and reliable information cannot be obtained without metering.

Acknowledgment is made for assistance received from colleagues in preparing this paper and to the Directors of Stoves, Ltd., for permission to publish it.

INTERNATIONAL GAS UNION

The Council of the International Gas Union met, under the chairmanship of its President (Colonel C. M. Croft), in Lausanne, during the Annual General Meeting of the Swiss Association of Gas and Water Engineers, which members of the Union Council also attended as guests of the Association.

One of the principal matters discussed by the Council was the programme of the 4th International Gas Conference which is to be held in London in June, 1949. Preliminary arrangements for the presentation and discussion of reports and papers were agreed. The date and programme of the Conference will be published in due course.

COURSES FOR TEACHERS

The Ministry of Education, at the request of the Gas Education Committee of the Institution of Gas Engineers, has agreed to resuscitate the courses for teachers which were conducted before the war, and which were acknowledged to be of great assistance to teachers in gas engineering and gas fitting.

A course will be conducted at the Rutherford College of Technology, Newcastle-upon-Tyne, 1, from July 17 to 24 inclusive. The course will be arranged by H.M.I. Dr. P. C. L. Thorne, M.A., M.Sc., and will be designed to suit the requirements of teachers in Gas Engineering (Manufacture) and (Supply) and Gas Fitting.

Full details will be published later, but, in the meantime, persons interested in the project are advised to communicate with the Secretary of the Institution of Gas Engineers, 1, Grosvenor Place, London, S.W.1, who will forward particulars as soon as they become available.

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PUBLICATIONS RECEIVED

The Cement and Concrete Association has compiled a *Bibliography of Cement and Concrete*, which comprises a list of books and papers in London libraries, arranged in chronological order. The list embraces the technical literature available which deals specifically with the subject of cement and concrete, but does not include publications devoted to constructional and civil engineering which contain references to concrete construction. An alphabetical list of authors is given, and the reference system assigns each item to the library where it can be consulted.

* * *

We have received from the publishers, the Saint Catherine Press, Ltd., a copy of a remarkable book entitled *Breathing in Irrespirable Atmospheres*. It is a remarkable book on account of the authority of the writer, Sir Robert H. Davis, who has devoted a lifetime to the study of the practical design of apparatus which enable one to breathe under abnormal conditions. In this work, remarkable also for the quality of production, the Author has been assisted by a group of eminent scientists whose combined work has led to the production of modern breathing appliances of all types. The volume, running to nearly 400 pages, is profusely illustrated in line, half tone, and colour, and includes an index obviously carefully compiled and appropriate to the very wide range of the subject-matter. Indicative of this range we may mention that the volume includes a short history of gas and incendiary warfare and covers in easily understandable language the physiology of respiration, the evolution of breathing apparatus, modern gas masks and other respiratory apparatus, and other aspects such as resuscitation and mine rescue operations. Sir Robert Davis is Managing Director of Siebe, Gorman & Co., Ltd., and the Gas Industry knows the debt which it owes to this firm, whose apparatus, of a special kind, is employed by gas undertakings throughout the country. In a foreword, Professor Sir Leonard E. Hill speaks of the foresight and enterprise shown by the Author in tackling the problem on which he writes, and Sir Leonard recalls the Author's initiative in building the only experimental plant in this country for research into deep diving, flying at great altitudes, and work in a poisonous atmosphere.

The price of the book, which is a veritable encyclopedia, is 25s. net.

GAS STOCKS AND SHARES

Following a period of unusual activity, dominated by the British Transport stock operation, generally subdued conditions marked the opening of last week in the stock markets. International political conditions influenced sentiment, and with a few exceptions industrial shares were dull. In the middle of the week the announcement of the details of the Marshall aid plan caused a rally which, however, proved to be short-lived as the result of Sir Stafford Cripps' warning of the possibility of a "descending spiral" of trade, which led to a certain amount of selling.

The recent increase in the number of transactions in gas shares was maintained and with the single exception of Holyhead and North Wales, which showed a fall of 4s. on the week, all the price changes were in an upward direction. Gas Light and Coke Ordinary, South Metropolitan, and Imperial Continental all showed fluctuations during the week, but of these three South Metropolitan was the only one to show a rise on the week. The increased buying was generally believed to have been influenced by nationalization prospects.

Price changes recorded during the week were as follows:

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British Gas Light, ord.	122	—127	+ 2
Cheltenham, 5 p.c. basic cons. ord.	98	—103	+ 1
Commercial, ord.	82	— 87	+ 2
Do. 3 p.c. deb. perp. ...	80	— 85	+ 3
Croydon, max. div.	98	—103	+ 1
Gas Light and Coke, 4 p.c. con. pref	97	—102	+ 1
Do. 3 p.c. con. deb. ...	85	— 90	+ 1
Holyhead & N. Wales, ord. ...	17/6	— 20/-	— 4s.
Liverpool, 5 p.c. ord.	118	—123	+ 3
Montevideo, Ltd., ord.	122	—127	+ 5
Romford, ord.	107	—112	+ 2
Sheffield, cons.	127	—132	+ 2
Do. 4 p.c. red. deb. (xd. Dec. 31)	97	—102	+ 1
South Metropolitan, ord. ...	96	—101	+ 1
Swansea, ord.	83	— 88	+ 1

GAS PRODUCTS PRICES

The London Market

Jan. 10.

There are no changes to report in the prices of Coal Tar products.

The Provinces

Jan. 10

Average prices for gas-works products this week are: Pitch, 100s. per ton; toluole, naked, North, 90's, 2s. 4d. to 2s. 6¾d. per gall; pure, 3s. 2¼d. Prices for carbolic acid 60's anthracene, creosote oil (hydrogenation), coal tar oils (timber preservation, &c.) and strained anthracene oil are controlled by Government Orders. Prices for road tar are increased by one penny per gall. by S. R. & O. 1947, 177.

Scotland

Jan. 10

Basic prices remain unchanged.

Refined tar.* Yield to the distiller is 6d. per gall. ex works, naked. Creosote oil. Timber preserving quality,* 5½d. to 6½d. per gall.; hydrogenation oil,* 5⅞d. per gall.; low gravity or virgin oil,† 7½d. to 7½d. per gall.; benzole absorbing oil, 6½d. to 8d. per gall. Refined cresylic acid is 3s. 6d. to 4s. 6d. per gall. ex works, naked, according to quality. Crude naphtha,† 8d. to 10d. per gall. Solvent naphtha.* Basic maximum prices delivered in bulk 90/160 grade, 2s. 10d. per gall., and 90/190 heavy naphtha, unrectified, 2s. 0½d. per gall.; rectified, 2s. 4d. per gall. Pyridine,† 90/160 grade 15s. per gall, and 90/140 grade 17s. per gall.

* Price controlled. † Uncontrolled.

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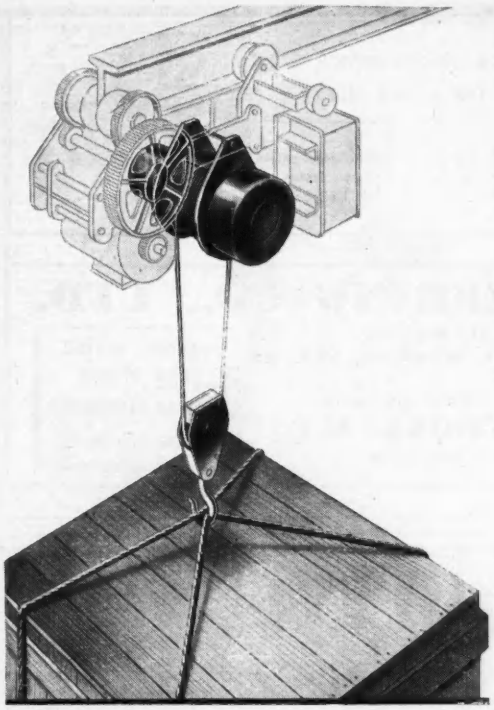

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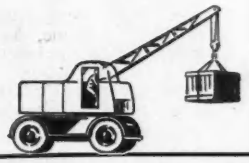

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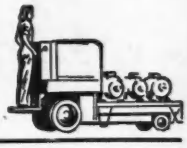

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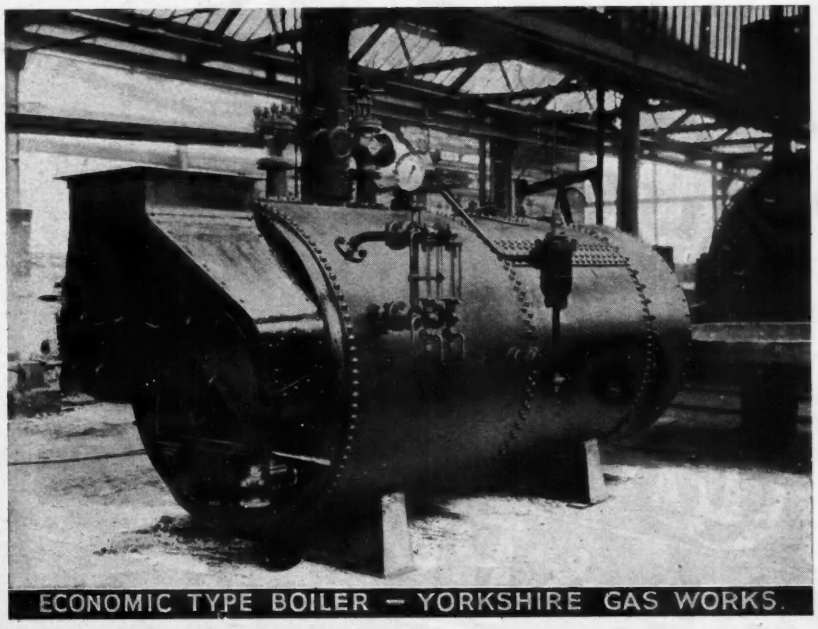

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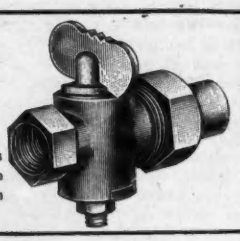
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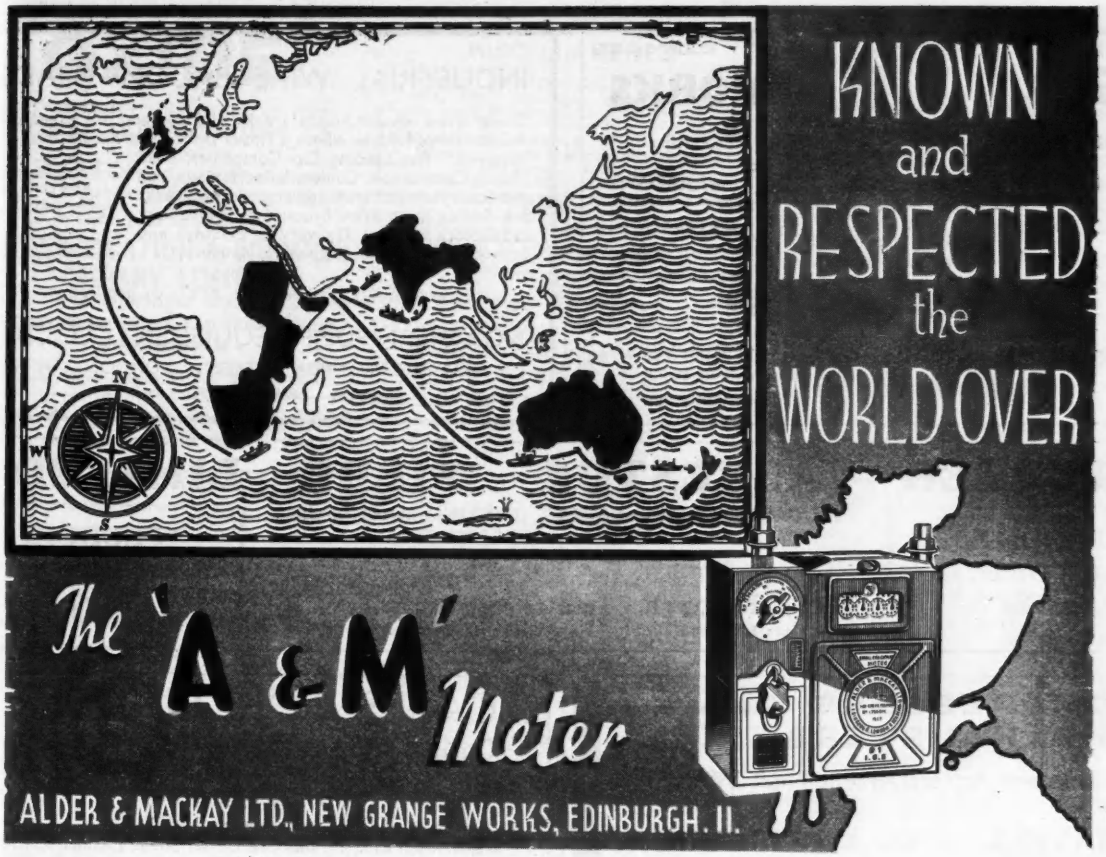

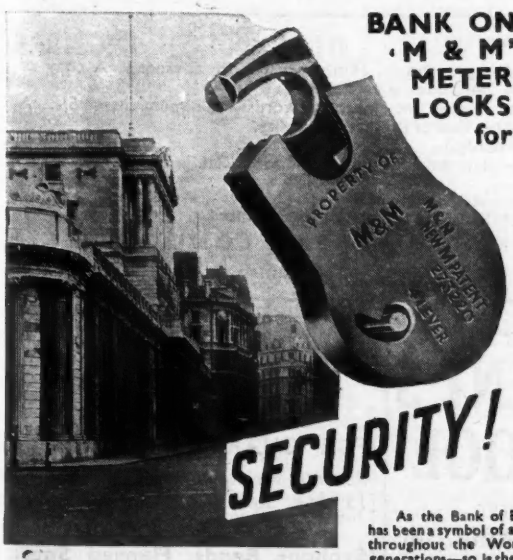

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SLAG WOOL WORKS, REDCAR, YORKS, T.N. Redcar 16

54/5, LONDON WALL, LONDON, E.C.2, T.N. City 4613

THE DEVONARC WELDING WORKS, The Old Tannery, Alphington, Exeter,

TELEPHONE: EXETER 54594

FOR GUARANTEED WELDING.

Recently we completed 2 miles of 8" and 15" H.P. Steel Gas Main Joints Without a Leak on Test.

Syphons, Bends, Flanged Specials, etc. Fabricated on site. A record of which we are proud.

WE GUARANTEE OUR WORK TIGHT BEFORE TEST!

PRESSURE WORK OUR SPECIALITY.

ARE YOU HELD UP FOR FLANGED PIPES, SPECIALS, ETC? WHY NOT TRY US? OUR MOTTO 'QUALITY FIRST.'

OXIDE

BEST QUALITY DUTCH BOG ORE
SPECIALLY ACTIVATED OXIDE OF IRON

which has stood the test of 70 years and rapidly absorbs 60% Sulphur (wet basis).

Send your enquiries to

GAS PURIFICATION & CHEMICAL COMPANY LIMITED
ESTABLISHED 1873

PALMERSTON HOUSE, 34, OLD BROAD STREET, LONDON, E.C. 2.

Telegrams: "Purification, Stock, London." Telephone: London Wall 5077

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THE COOKER CLEANER

Tins for Sale to Consumers. In Bulk for Works Use.

OXIDE OF IRON.

BALE & CHURCH, LTD.
33, ST. MARY AT HILL, LONDON, E.C.3.

Telephone: Mansion House 1156. Telegrams: "Balefire, London."

BOG ORES

IRISH
BELGIAN and DUTCH

HARRISONS (LONDON) LTD.
66, MARK LANE, LONDON, E.C. 3

Telegrams: "BIRCHROCK, LONDON." Telephone ROYal 3120.

PATENTS

MEWBURN, ELLIS & CO.,
CHARTERED PATENT AGENTS
AND TRADE MARK AGENTS
70 & 72, Chancery Lane, London, W.C.2.
Telegrams: "Patent, London." Phone: Holborn 0437
And 3, St. Nicholas Buildings, Newcastle-on-Tyne.

PLANT, &c.

ROBERT DEMPSTER & SONS, LTD., ELLAND, Builders of CARBONIZING PLANTS, both Horizontal and Vertical. Manufacturers of CONDENSERS, PURIFIERS GASHOLDERS, &c., also every description of COAL and COKE HANDLING PLANT. *Telegrams:* "Dempster, Elland." *Telephone:* Elland 2241, 2242 and 2243.

FIRTH BLAKELEY, SONS & CO., LTD.
Vulcan Ironworks, Church Fenton, Yorks.
MANUFACTURERS of Gasholders, Tanks, Condensers, Purifiers, Scrubbers, Washers, and every description of Gas Plant.
Sole Makers of the "P.M" semi-water Gas Plant
Telegrams: "Blakeleys, Church Fenton."
Telephone: Barkston Ash 234 and 235 (Private Branch Exchange). Code: "Bentleys."

MISCELLANEOUS

VITREOUS ENAMELLING. Capacity available. High class work. FOICIK & SON, 36, Western Road, Plaistow, E.13. Gra. 4524.

MONOMARK SERVICE. Permanent London address. Letters redirected immediately. Confidential. 5s. per annum. Royal patronage. Write MONOMARK, BCM/MONO5H, W.C.1.

REPAIRS

REPAIRS to CLOCKWORK CONTROLLERS for street lighting, Clocks, Time Switches and every kind of clockwork mechanism. J. W. & R. E. Hughes (Clockwork Engineers), 58, Victoria Street, London, S.W.1. Phone: Victoria 0134.

PAYNE & FLOOD, LTD., 182, Oldham Road. Manchester, 4, Phone Col. 1393, are in a position to undertake all types CARBONIZING PLANT REPAIRS, Retort House Reconstruction, Producer Relinings, Hot and Cold Patching, Structural Steelwork Erected and Dismantled. Expert advice available.

EDUCATIONAL

UNIVERSITY OF LEEDS

GAS RESEARCH FELLOWSHIP.

APPLICATIONS are invited for an OPEN FELLOWSHIP (annual value £325) established by the Institution of Gas Engineers for the prosecution of post-graduate research in Gas Chemistry. Further particulars may be obtained on request. Applications, together with the names of two referees, should reach the REGISTRAR, The University, Leeds, 2, not later than February 29, 1948.

BRITISH COKE RESEARCH FELLOWSHIP.

Applications are invited for a BRITISH COKE RESEARCH FELLOWSHIP (annual value £350) tenable in the Department of Coal Gas and Fuel Industries. Further particulars may be obtained on request. Applications, together with the names of two referees, should reach the REGISTRAR, The University, Leeds, 2, not later than February 29, 1948.

CONTRACTS OPEN

COUNTY BOROUGH OF SOUTHPORT
(GAS DEPARTMENT.)

CARBURETTED WATER GAS PLANT.

TENDERS are invited for the supply, delivery and erection of the following plant :—

A fully automatically operated, self clinkering, self charging CARBURETTED WATER GAS AND PRODUCER GAS PLANT, together with all ancillary coke handling facilities.

Full particulars and specification together with form of tender may be had on application to the General Manager, Southport Corporation Gas Department, 91, Eastbank Street, Southport.

Tenders to be forwarded to the undersigned in plain, sealed envelopes, and endorsed "C.W.G. Plant," so as to reach this office not later than the first post on Saturday, January 31, 1948.

R. EDGAR PERRINS,
Town Clerk.

Town Hall,
Southport.

CITY OF HEREFORD

PAINTING OF GASHOLDERS.

TENDERS are invited for the PAINTING of three Gasholders situate at Mortimer Road, Hereford.

Further particulars and copies of the specification and general conditions of contract may be obtained on application to A. Facer, F.C.I.S., M.Inst.Gas E., A.M.I.Struct.E., M.Inst.F., Engineer and General Manager, Gas-works, Mortimer Road, Hereford.

Tenders, enclosed in plain sealed envelopes, endorsed "Painting of Gasholders," should be forwarded to the undersigned to be received not later than noon on Saturday, January 31, 1948.

The Corporation does not bind itself to accept the lowest or any tender.

T. B. FELTHAM,
Town Clerk.

Town Hall,
Hereford.

CITY OF HEREFORD

SITE PREPARATION, GAS-WORKS EXTENSION

TENDERS are invited for the supply and delivery of MATERIALS, EXCAVATION AND CONSTRUCTION of Concrete Roads, the laying of a 24 in. diameter Concrete Sewer, Surface Drains, Concrete Floor, Railway Siding and Fencing, situate on the new extension, Gas-works, Mortimer Road, Hereford.

Further particulars and copies of the specification and general conditions of contract may be obtained on application to A. Facer, F.C.I.S., M.Inst.Gas E., A.M.I.Struct.E., M.Inst.F., Engineer and General Manager, Gas-works, Mortimer Road, Hereford, accompanied by a deposit of £2 2s., which will be refunded on receipt of a *bona fide* tender.

Tenders, enclosed in plain sealed envelopes, endorsed "Site Preparation—Gas-works Extension," should be forwarded to the undersigned to be received not later than noon on Saturday, January 31, 1948.

The Corporation does not bind itself to accept the lowest or any tender.

T. B. FELTHAM,
Town Clerk

Town Hall,
Hereford.

CITY OF MANCHESTER
(GAS DEPARTMENT.)

THE Gas Committee invites tenders for the supply and delivery of RUBBER CONVEYOR BELTS.

Specification and form of tender may be obtained from the Commercial Manager and Secretary, Gas Department, Town Hall, Manchester, 2.

Sealed tenders in the envelope provided, addressed to the Chairman of the Gas Committee and endorsed "Conveyor Belts," must be delivered at the Gas Office, Town Hall, Manchester, 2, not later than 10 a.m. on Tuesday, January 20, 1948.

The Committee does not bind itself to accept the lowest or any tender.

PHILIP B. DINGLE,
Town Clerk.

Town Hall,
Manchester 2
January, 1948.

COUNTY BOROUGH OF STOCKPORT
(GAS DEPARTMENT.)

TENDERS are invited for the annual requirements of the following materials :

(1) BRASS FITTINGS.
(2) C.I. PIPES AND IRREGULARS.
(3) CEMENT.
(4) GRANITE CHIPPINGS.
(5) HAMMER SHAFTS, &c.
(6) METER SKINS.
(7) PIPE HOOKS AND CLIPS.
(8) SHEET GLASS.
(9) SHOVELS.
(10) SOLDER.
(11) STEEL FILES
(12) WASHED SAND.
(13) FITTERS' TOOLS.

Full particulars and specifications may be obtained on application to H. Russell, Secretary, Gas Department, Town Hall Annexe, Stockport.

Tenders to be enclosed in plain sealed, endorsed envelopes, addressed to the Chairman of the Gas Committee, Town Hall, Stockport, and to be received not later than February 7, 1948.

The Corporation does not bind itself to accept the lowest or any tender.

ARTHUR BOND,
Town Clerk.

Town Hall,
Stockport.
January 3, 1948.

PLANT FOR SALE & WANTED

WANTED. Steam-driven EXHAUSTER. Capacity 25,000 to 30,000 cu.ft. per hour. Age and full details to be forwarded to the ENGINEER AND MANAGER, Conway Gas Co., Ltd., Castle Street, Conway.

GAS FITTINGS. Surplus stock of 19,000 Brass Gass Fittings for sale. Mostly ½ in. gas or ¼ in. brass threads. Apply No. 9697, "GAS JOURNAL," 11, Bolt Court, Fleet Street, E.C.4.

PHONE 98 STAINES.

FOR SALE STEEL OPEN TOP TANK, 30 ft. by 9 ft. by 5 ft. 34 kW STEAM GENERATING SET, 220 volts D.C. LANCASHIRE BOILER, 14 ft. by 6 ft., 80 lb. w.p. STEEL CONDENSER, 16 ft. long by 2 ft. diameter 20 H.P. BROTHERHOOD DIESEL LOCOMOTIVE 24 in. gauge. Bailey AIR COMPRESSOR, 100 cu.ft., 100 w.p. 5 h.p., 7 h.p., and 25 h.p. Crossley GAS ENGINES.
HARRY H. GARDAM & Co., LTD., Staines.

WANTED. COMPRESSOR, with or without motor, to deliver 5,000 cu.ft. per hour at about 3 p.s.i. Alternatively, would consider two machines of half above throughput. Full particulars and price to THE RUSHDEN DISTRICT GAS COMPANY, Gas-works, Rushden, Northants.

FOR SALE—One 6 in. STATION GOVERNOR, by Willey & Co., complete with by-pass and valves.

One 5 h.p. NATIONAL GAS ENGINE, magneto ignition.

One 6 in. STATION GOVERNOR by W. Parkinson, complete with valves.

One STATION METER, 3,000 cu.ft. per hour, no valves.

Three new Holmes 6 in. double-faced VALVES.

Six 4 lt. ROCHESTER SUSPENSION LAMPS.

Ten 16 in. WINDSOR LANTERNS with 2 lt. burners.

Further details may be obtained from J. C. COTTERILL, Engineer and Manager, Gas-works, West Bridge, St. Austell.

URBAN DISTRICT COUNCIL OF TYLDESLEY
(GAS DEPARTMENT.)

OFFERS are invited for the purchase of a TRACK SUSPENDED CHARGING MACHINE AND COAL ELEVATOR, in good working condition. Makers W. J. Jenkins & Co., Ltd.

Further particulars can be obtained from the Engineer and Manager, Gas-works, Tyldesley.

Offers should be forwarded to the undersigned.

No undertaking is given to accept the highest or any tender.

Dated January 7, 1948.

RICHARD F. WILSON,
Clerk of the Council.

Town Hall,
Tyldesley,
Lancs.

(*Classified advertisements continued on Supplement 6*)

COMPANY NOTICES

THE GAS LIGHT AND COKE COMPANY

NOTICE is hereby given that an ORDINARY GENERAL MEETING of the Proprietors of the Gas Light and Coke Company will be held at Gas Industry House, 1, Grosvenor Place, S.W.1, on Thursday, February 19, 1948, at 12 o'clock (noon) precisely, to transact the usual business, including the declaration of Dividends for the half-year ending on December 31, 1947, and to elect Directors and Auditors in compliance with the Company's Acts or Schemes of Amalgamation.

The Transfer Books so far as they relate to the Ordinary, 4% Consolidated Preference and 3½% Maximum Stocks will be closed at 4 p.m. on January 19, 1948, and will be re-opened immediately after the Ordinary General Meeting.

By Order,
BRIAN WOOD,
Secretary.

Chief Office,
30, Kensington Church Street,
London, W.8.
January 1, 1948.

SOUTH SUBURBAN GAS COMPANY

NOTICE IS HEREBY GIVEN that the ANNUAL ORDINARY MEETING of the Proprietors of this Company will be held at the Livesey Memorial Hall, Lower Sydenham, S.E.26 (adjoining the Chief Office), on Thursday, February 19, 1948, at 11.15 o'clock in the forenoon precisely, for the following purposes :

To receive the Report of the Directors and Statement of Accounts for the year ended December 31 last.

To declare a dividend for the half-year ended the same date.

To elect two Directors in the place of those retiring by rotation.

To elect a new Auditor in place of one retiring and to authorize an increase in the Auditors' remuneration.

And for general purposes.

NOTICE IS HEREBY ALSO GIVEN that, in accordance with the Standing Orders of Parliament, an EXTRAORDINARY MEETING of the Proprietors of this Company will be held at the same place at 11.30 o'clock in the forenoon of the same day or so soon thereafter as the business of the Ordinary Meeting of such Proprietors to be held on the same day shall have been concluded, for the purpose of considering, and, if thought fit, of approving a Bill which has been introduced into Parliament in the present Session, entitled :

"A Bill to confer further powers on the South Suburban Gas Company ; and for other purposes."

The Transfer Books relating to the Ordinary and Preference Stocks of this Company will be closed from February 6 to February 19, both days inclusive.

Dated January 8, 1948.
By Order of the Board,
D. L. HORLOCK,
Secretary.

APPOINTMENTS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50, inclusive, or a woman between the ages of 18 and 40, inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1947, or the vacancy is for employment excepted from the provisions of that Order.

THE WORCESTER NEW GAS LIGHT COMPANY

ASSISTANT CHEMIST.

APPLICATIONS are invited for the position of ASSISTANT CHEMIST. Candidates should have had experience in the control of vertical retorts, C.W.G. and purification plants, &c.

Commencing salary not less than £350 per annum according to experience.

Apply, stating age, experience, &c., to the undersigned.

GEO. P. MITCHELL, M.I.C.E.,
Managing Director.

THE YORKSHIRE INDUSTRIAL GAS CENTRE LIMITED.

APPLICATIONS are invited for the position of an ASSISTANT INDUSTRIAL GAS ENGINEER at the above Centre. The commencing salary will be in accordance with experience and qualifications, but will be not less than £450 per annum.

Applications giving full details should be sent to the SECRETARY, The Yorkshire Industrial Gas Centre, Ltd., Meadow Lane Gas-works, Leeds, 11, not later than January 31, 1948.

STROUD GAS LIGHT AND COKE COMPANY

APPLICATIONS are invited for the position of TECHNICAL ASSISTANT to the Distribution Superintendent at a salary of £400 per annum.

Experience of high and low pressure gas distribution and capable draughtsman essential, minimum standard required Ordinary Grade Certificate on Gas Engineering (Supply).

House available at moderate rental if required.

Profit sharing and superannuation scheme in operation.

Applications to be submitted on or before February 6, 1948, and addressed to ENGINEER AND MANAGER, Gas-works, Canal Side, Stroud, Glos.
January 9, 1948.

JUNIOR FITTINGS SUPERINTENDENT required in Ceylon for Gas Company. Single man preferred, age about 25, who has trained as gas fitter and could supervise. Salary £500 per annum and cost of living allowance, at present £320 per annum, plus bonus, house allowance, provident fund. Home leave after first five years' service and thereafter leave every four years. Passage paid. Apply in writing, giving full particulars of experience, age, &c., to THE COLOMBO GAS AND WATER COMPANY, LIMITED, 148, Gresham House, London, E.C.2.

WEST RIDING GROUP OF GAS COMPANIES

APPLICATIONS are invited for the position of LOCAL SUPERINTENDENT at Garforth, to be responsible under the Area Manager for service, sales and distribution of gas in the townships of Garforth, Aberford and Barwick. Minimum qualifications should comprise the Ordinary Grade Certificate in Gas Engineering (Supply), supported by extensive practical experience, firstly in gas fitting and appliance installation and maintenance, and latterly as a Distribution Superintendent or Assistant.

Salary £375 per annum, subject to periodical review. A house will be provided rent and rates free when vacated by the present Superintendent following upon his promotion. A lodging allowance of 30s. per week will be paid meanwhile.

All gas is purchased in bulk at each station. The vacancy thus offers an opportunity for a man qualified in distribution to acquire management experience.

Applicants should give full details of practical experience, qualifications and positions held. Present salary should be stated. *Copies* of three recent Testimonials should be enclosed. Applications to be submitted before January 26, 1948, to H. B. TAYLOR, General Manager, West Riding Group of Gas Companies, Warrengate, Wakefield.

COUNTY BOROUGH OF BLACKPOOL

(GAS DEPARTMENT.)

APPLICATIONS are invited for the post of CHARGE HAND, Fitting Shop, at the Clifton Road Works, Blackpool, at a wage of £8 per week inclusive.

It is essential that applicants should be skilled engineers and have gas-works training.

The successful applicant will be required to undergo a medical examination conducted by a doctor nominated by the Corporation.

Applications, containing full particulars as to age, past employment, together with *copies* of two recent Testimonials, should be received by the Gas Engineer and General Manager, Gas Offices, Princess Street, Blackpool, not later than Monday, February 2, 1948.

Canvassing of members of the Council will be a disqualification.

This advertisement does not apply to men normally employed in agriculture or coal mining. It appears by permission o the Ministry of Labour and National Service.

TREVOR T. JONES,
Town Clerk.

Town Hall,
Blackpool.
January 7, 1948.

BRISTOL GAS COMPANY

CHIEF FOREMAN, MAINS DEPARTMENT.

APPLICATIONS are invited for the above position. Applicants should have a thorough practical and theoretical knowledge of high and low pressure main and service laying. Ability to organize and control labour is essential.

A flat will be available early this year at reasonable rental if desired.

Wage, including war bonus, £7 8s. per week.

Applications, stating age, training, experience and qualifications, together with *copies* of two recent Testimonials, should be sent to the undersigned not later than January 24, 1948.

This advertisement is inserted by permission of the Ministry of Labour and National Service under the Control of Engagement Order, 1946.

JAMES CARR,
Engineer and General Manager.

Radiant House,
Bristol, 1.

BOROUGH OF WIDNES

(GAS AND WATER DEPARTMENT.)

APPOINTMENT OF ENGINEERING ASSISTANT.

This advertisement is inserted by permission of the Ministry of Labour and National Service under the Control of Engagement Order, 1947.

APPLICATIONS are invited for the position of ENGINEERING ASSISTANT in the Gas and Water Department of the Borough of Widnes. Candidates should not be over 40 years of age. The salary offered is in accordance with the A.P.T. Grade IV of the National Scales, *i.e.*, £420, rising by annual increments of £15 to £465 per annum, plus a cost of living bonus, which is at present £59 16s. per annum.

Applicants must have received a thorough training and acquired adequate subsequent experience in gas-works engineering practice obtained with gas undertaking(s) or with constructional contractor(s) to the Gas Industry ; considerable satisfactory service in the control of gas-works plant and employees is essential. Applicants should also possess one or more of the following technical qualifications : Science Degree of a British University, Diploma or Higher Grade Certificate in Gas Engineering (Manufacture), Membership or Associate Membership of the Institute of Gas Engineers, or the Institute of Mechanical Engineers, or the Institute of Civil Engineers.

Experience in water engineering will be considered an advantage.

Applications for the appointment must be made on the special form to be obtained from the Gas and Water Engineer and Manager, Ann Street East, Widnes, and must be completed and posted to that address not later than Monday, February 16, 1948. The appointment is subject to the National Scheme of Conditions of Service adopted by the Widnes Town Council, and the successful candidate will be required to pass a medical examination.

JAMES WALLACE,
Town Clerk.

Town Hall,
Widnes.
January 6, 1948.

BOOKS IN STOCK

THEORY OF INDUSTRIAL GAS HEATING
PETER LLOYD. 7/6 post free

CARBONIZATION IN HORIZONTAL RETORTS
G. M. GILL. 3/- post free

DOMESTIC UTILIZATION OF GAS
Parts 1 & 2 (Combined Edition)
SMITH & LE FEVRE. 15/6 post free

GOVERNORS AND GOVERNING
A STUDY OF PRESSURE CONTROL FOR THE GAS ENGINEER AND STUDENT
B. R. PARKINSON, M.I.Mech. E., Hon.M.Inst.Gas E.
22/6 post free

GAS SERVICE POCKET BOOK
NORMAN S. SMITH. 3/6 post free

GAS JOURNAL CALENDAR & DIRECTORY
25/- post free

GAS JOURNAL OFFICES
11, Bolt Court, Fleet Street, London, E.C.4

Get in on the Under Belly of RUST (Engineers' Enemy No 1.)
Years of Wear instead of Weeks
GRANT & WEST LTD
'PHONE NORTH 2160

Steel Wires, Ropes & Cables running in and out of Water, Gas, Sulphurous Fumes, etc. will never RUST if treated with
ROPRES
IT KILLS RUST
STAYS on every STRAND.

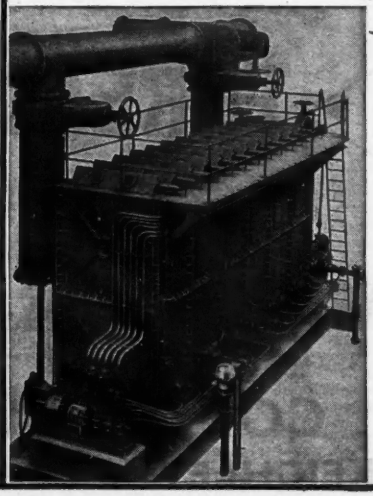
RUST KILLS ROPES,—but ROPRES rope preservative KILLS RUST. Use ROPRES.
Try a Tin on our Guarantee
3, Furlong Road, London, N.7.
'GRAMS-"SELEKJOINA, HOLWAY, LONDON"

FOUNDED 1850
HOLMES
HUDDERSFIELD

MULTIFILM WASHERS

LIQUOR SPRAYS WITH ROTATABLE SPRAY PIPE FOR CLEANING OBSERVATION WINDOWS

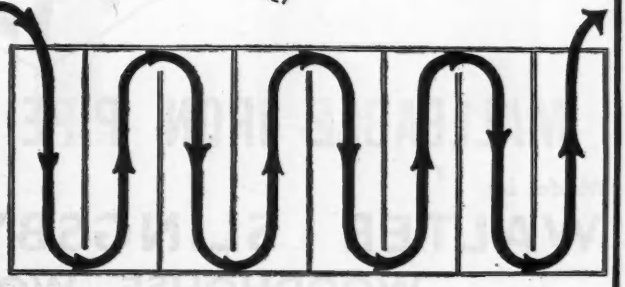
FLOW OF GAS



FLOW OF LIQUOR

British Patents Nos. 357,712/30 and 366,646/30

PLAN VIEW SHOWING FLOW OF GAS



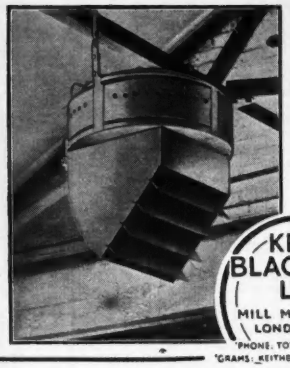
W. C. HOLMES & CO. LTD. · HUDDERSFIELD · LONDON · BIRMINGHAM

C 263

Easily and quickly installed units for warming workshops, etc.

Above : A large workshop warmed by "KB" Gas-fired Unit Heaters. Inset : Close-up of one of the units. Each unit consists of screen-protected gas burners combined with an electric circulating fan, and a louvred casing which throws the warmed air in the direction desired. The unit can be supplied without louvres, when it discharges the warmed air with a rotatory effect.
Write for Catalogue No. V-181.

"KEITH-BLACKMAN" UNIT HEATERS
GAS-FIRED TYPE



KEITH BLACKMAN LTD.
MILL MEAD ROAD, LONDON, N.17.
'PHONE: TOTTENHAM 4522
'GRAMS: KEITHBLAC, PHONE, LONDON"

TO ENSURE PRESSURE-TIGHT JOINTS

SPECIFY

TAPER WASK THREAD

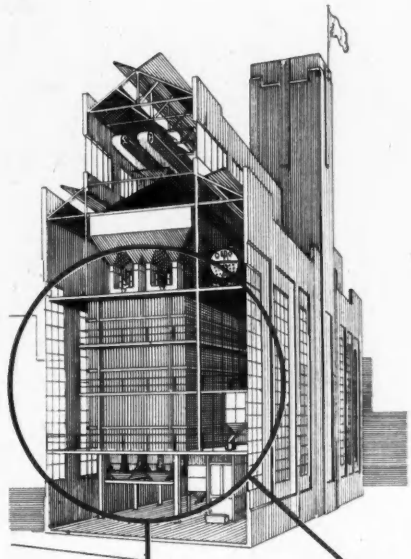
MALLEABLE IRON PIPE FITTINGS & UNIONS

Made by

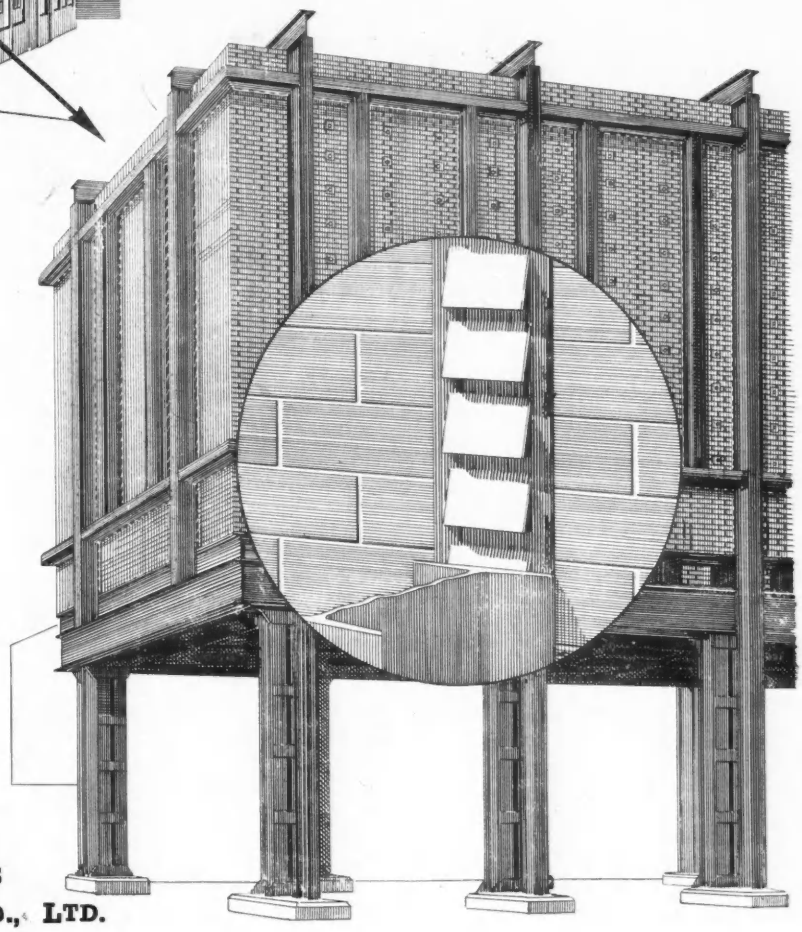
WALTER SLINGSBY & CO., LTD.,
WOODHOUSE WORKS, KEIGHLEY

Grams : "Malleable" Keighley. **Phone : Keighley 3749 (2 lines)**

Printed by Straker Brothers Ltd., E.C.2, for WALTER KING LIMITED, 11, BOLT COURT, FLEET STREET, LONDON, E.C.4.—Wednesday, January 14, 1948.



MODERN DEVELOPMENTS
IN THE
GLOVER-WEST SYSTEM
OF
CONTINUOUS CARBONIZATION
IN
VERTICAL RETORTS



III PROGRESS

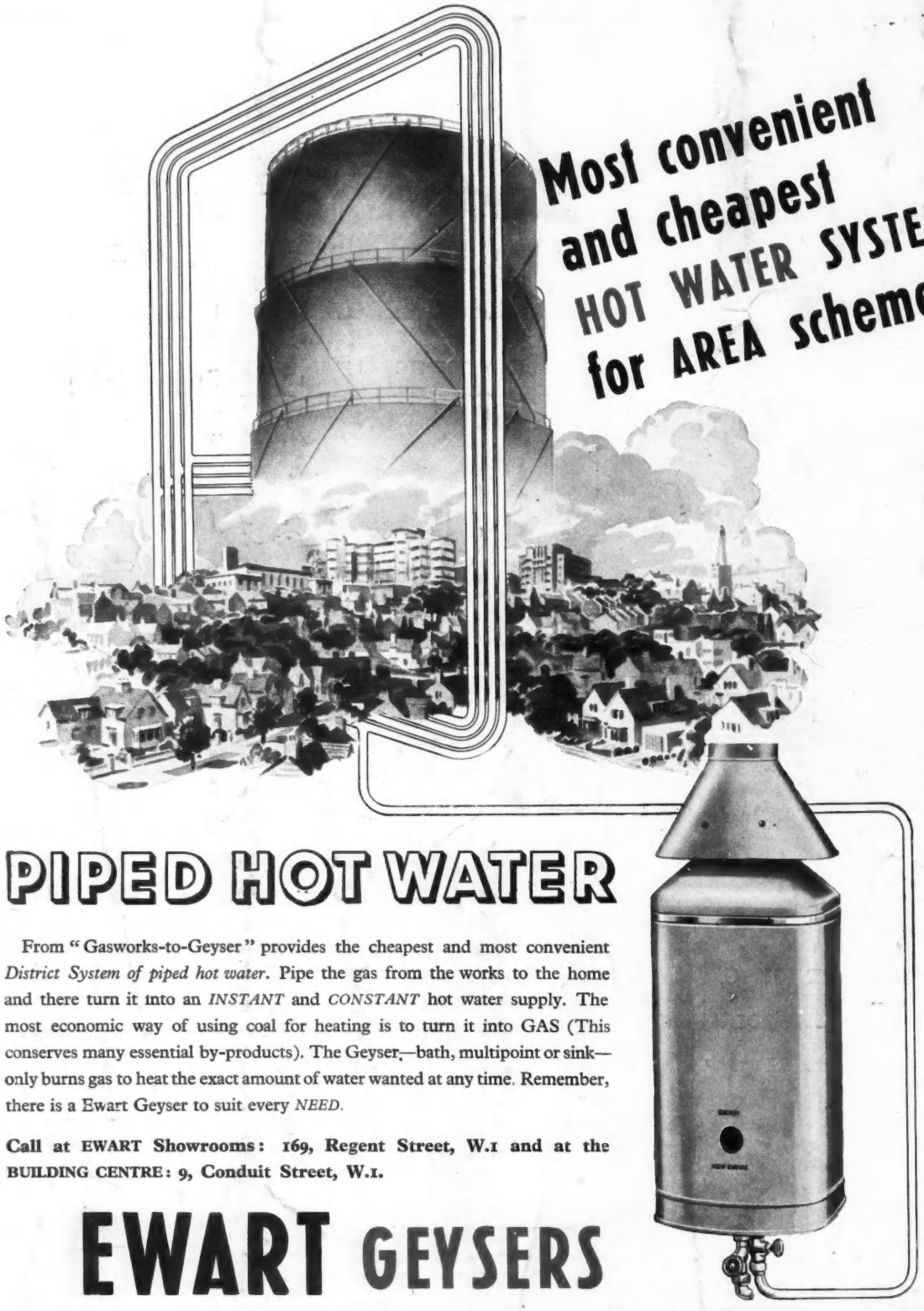
BENCH BRACING
WITH
EVEN CONTROL
OF
EXPANSION

WEST'S GAS IMPROVEMENT CO., LTD.

Miles Platting, MANCHESTER 10

Telephone: COLlyhurst, 2961-2-3-4-5
Telegrams: Stoker, Manchester

London Office: Columbia House, Aldwych, W.C. 2
Telephone: HOLborn 4108-9
Telegrams: Wesgasco, Estrand



Most convenient and cheapest HOT WATER SYSTEM for AREA schemes!

PIPED HOT WATER

From "Gasworks-to-Geyser" provides the cheapest and most convenient *District System of piped hot water*. Pipe the gas from the works to the home and there turn it into an *INSTANT* and *CONSTANT* hot water supply. The most economic way of using coal for heating is to turn it into GAS (This conserves many essential by-products). The Geyser,—bath, multipoint or sink—only burns gas to heat the exact amount of water wanted at any time. Remember, there is a Ewart Geyser to suit every *NEED*.

Call at EWART Showrooms: 169, Regent Street, W.1 and at the BUILDING CENTRE: 9, Conduit Street, W.1.

EWART GEYSERS

MULTIPOINT • BATH • SINK

EWART & SON, LTD., 169 REGENT ST., W.1. Works: LETCHWORTH, HERTS. Estd. 1834.

8561

Branch Office: Waterloo Chambers, Fir Vale Road, BOURNEMOUTH. *TEL.* Bournemouth 4882
Scottish Agents: JAMES R. THOMSON & Co. Ltd., 10, Blythswood Street, Glasgow, C. 2
Northern Ireland Agents: CENTRAL MERCHANTS Ltd., Upper Queen Street, Belfast